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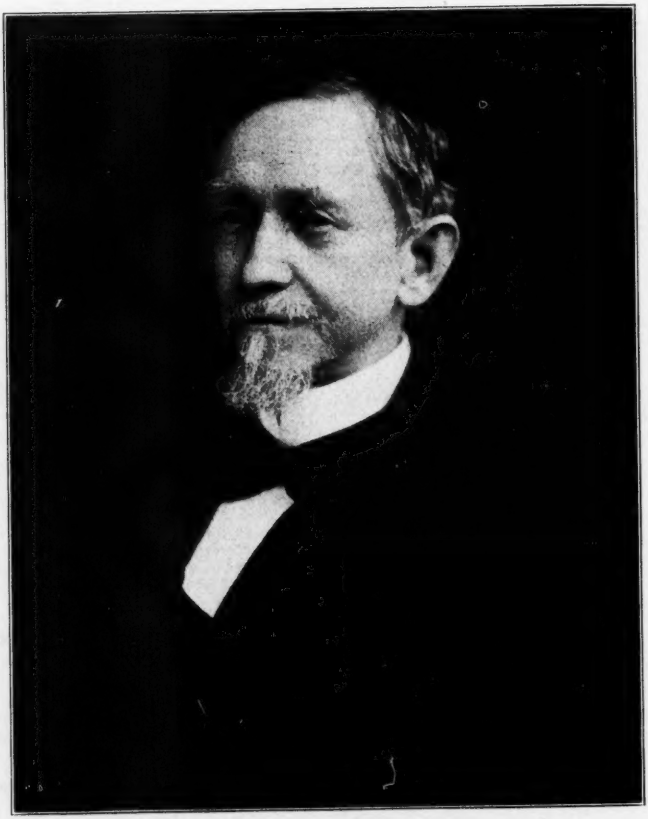

WILLIAM H. TRUEMAN, D.D.S.
(1843-1927)

THE JOURNAL
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Original Communications

THE EFFECTS OF THE LOSS OF THE FIRST PERMANENT MOLAR*

By BURNE O. SIPPY, B.S., D.D.S., M.S., Chicago, Illinois

IN a review of the scientific literature in medical and dental journals, many articles are found treating either directly or indirectly the problems involving the first permanent molar in the development of the human denture.

At the present time, conflicting theories exist among orthodontists, dentists and physicians with reference to the scientific value of the first permanent molar in its relation to occlusion and to the management of malocclusion. These theories have had their influence on the dental profession as exemplified in articles and discussions published.

A summary of the review of the literature may be made by saying that the authors are about equally divided in favor of and against the extraction of the first permanent molars, with a smaller group who are more conservative, taking an intermediate position, namely, extraction in some instances and not in others.

Those in favor of extraction claim that it relieves the crowded condition of the teeth in the arches, the second molars moving forward to take the place of the first molars and the third molars taking the place of the second molars, and thus the denture is greatly improved; also that this procedure is much the easiest and quickest way to obtain the desired result.

Those in favor of preserving the first permanent molar whenever possible point out its importance in the development of the face and jaws, and its

*Read before the Illinois State Dental Society, Peoria, Ill., May 10, 1927.

effects in producing and maintaining occlusion.

The conservative group are not so ready to extract first permanent molars unless the molars are in a very bad condition, or unless the shape of the face seems to indicate that the extraction will not show its effect. Some of this group would, in arches having crowded teeth, extract the bicuspids rather than the first molar, to relieve the crowding and improve the denture.

The advocates of extraction either of the first molar or the bicuspid differ as to how far to carry the plan. Some would extract only one tooth; some advise the extraction of the same tooth on both sides of the arch; while others advise the removal of all four corresponding teeth, if any are to be lost, to relieve the crowded arches, on the premise that the least amount of damage will be done to the denture by such a procedure.

There is no trend of interest either for or against the extraction of the first molar in the literature from 1856 to the present time. Considering the literature chronologically, the proportion of arguments for and against is about equal. Most of the statements in the articles and discussions reviewed have been made on the basis of experience in individual practice extending over a period of years, without data or systematic study of effects. Such opinions are not always logical or correct, nor are they clearly expressed. At least one exception is an article by Frederick B. Noyes (1922) which includes photographs, orthodontia casts of the jaws and case histories of patients presented in the article.

In order to determine which of the before mentioned groups are sound in their advice, I determined to make a study of the problem upon a scientific basis involving dentures which had had time to show the effects of first molar loss, and thereby eliminate the "hearsay" element.

Orthodontia models were made from impressions of mouths of a group of about 400 individuals, from 18 to 30 years of age. This collection was begun at the orthodontia clinic of the University of Illinois, College of Dentistry, in 1918. The mouths represented by this group had received the ordinary dental care but no orthodontic management. There are no case histories accompanying the models and no photographs or radiograms. Therefore, the models were studied all the more carefully and the selection and classification of a model was made only when it presented unquestionable conditions. This cut down the number of models available very materially. One hundred models which showed a loss of the first permanent molar were selected, and were classified in several ways in order to determine in what manner they could be studied best. The 100 models were finally grouped.

The number falling in each group is shown in Table 1.

TABLE 1.—GROUPING OF MODELS STUDIED

Group	No.
4 first molars missing	6
3 first molars missing	12
2 upper first molars missing	1
1 upper first molar missing	10
2 lower first molars missing	31
1 lower first molar missing	30
2 first molars missing in opposite sides and opposite arches	10

The individual models of each group were then studied to determine the relation of the loss of the first permanent

molar to the occlusion. It is quite obvious that the time allowed for this paper will not permit of a detailed description of the findings in each model or even in each group of models. The manuscript and tables covering this part of the research work covers twenty or more typewritten pages. A summary of the findings in all groups is presented in Table 2.

TABLE 2.—SUMMARY OF ALL GROUPS*

No. of Models	Condition Shown
80	Normal mesiodistal relation of the arches
6	Mesial occlusion of the arches
14	Distal occlusion of the arches
29	Narrow arches
15	Short arches
18	Narrow and short arches
38	Length and width of arches apparently not affected
68	Malposition of teeth
32	Little disturbance in masticating efficiency
64	First permanent molars missing only, excepting third molars
36	First permanent molars and other teeth missing
15	Twenty-one bridges
85	No artificial restoration of the missing first permanent molars
118	Spaces partly closed, 44 by tipping, 41 by drifting, 33 by tipping and drifting
23	Spaces partly closed, 6 by tipping, 8 by drifting, 9 by tipping and drifting
43	Spaces maintained by bridgework or occlusion
21	Spaces developed between other teeth in the denture, a result of the loss of first permanent molars

*One hundred models representing 184 missing first molars.

RECAPITULATION OF FINDINGS

The proportion of malocclusion belonging to each class of malocclusion has been given as about 70 per cent having normal mesiodistal relation of the arches, 4 per cent having mesial occlusion and 26 per cent having distal occlusion. In the study of the 100 models, it is recorded in the summary of findings that the malocclusion follows about the same proportion: 80 per cent have normal mesiodistal relation of the arches, 6 per cent have mesial occlusion and 14 per cent have distal occlusion.

No study has been recorded as to the relationship of arch conformation to malocclusion in any series of dentures as far as I know. In this study it is found that 38 per cent have arches apparently not affected in length and width; 29 per cent have narrow arches; 15 per cent have short arches, and 18 per cent have short and narrow arches. Therefore, 62 per cent have been affected in length and width. This would seem to be a large percentage, a much larger percentage than would be expected in a group of 100 models showing malocclusion. This high percentage of undersized arches is due to the collapse of the arches or failure of normal development of the arches because of the loss of the first permanent molars.

It is found that 68 per cent of the dentures show malposition of teeth. A

large percentage of this group have very serious malpositions of teeth as none were recorded as such unless of a serious nature. The percentage of dentures showing little disturbance in masticating efficiency is 32. It is a natural conclusion that the percentage of malposed teeth has not been reduced by the loss of the first permanent molars, and the crowding of teeth, so-called, has not been relieved. As there are no records available as to the proportion being considered, it is difficult to draw comparisons, but it would seem that the percentage of dentures having serious malpositions is relatively high considering all classes of malocclusion.

Of the dentures studied, 64 per cent have lost one or more first permanent molars, excepting the third molars; 36 per cent of these dentures have other teeth missing in addition to the first molars; 61 per cent have one or both lower first molars missing without the absence of either upper first molar; 89 per cent have lost one or both lower first molars with the absence of one or both upper first molars. Only 11 per cent of the 100 dentures have lost one or both upper first molars without the loss of either lower first molar. The high percentage of lower first molar extractions is significant. It is evident that the first molar is the one tooth in the denture which has been the prey of the extracting forceps, and particularly the lower first permanent molar.

No artificial restorations of the missing first molars by dental bridges was found in 85 per cent of the dentures. Only 15 per cent of the dentures have bridgework. This represents twenty-one bridges of a possible 184. This is a surprisingly low percentage of restorations, and it accounts for many of the complications in the malocclusion of most of the dentures. In the forty-three first molar spaces maintained, only twenty-one bridges are a factor, the remaining twenty-two spaces being maintained by the normal influences of occlusion or because of the fact that the extractions have been recent, sufficient time not having elapsed to determine whether or not the influences will continue to maintain these spaces.

Of the 118 spaces partly closed, in forty-four this condition has resulted from the tipping of adjacent teeth, which changes the long axis of these teeth. The partial closure of thirty-three spaces of lost first molars has resulted from the tipping and drifting of adjacent teeth; therefore, 77 of the 118 spaces have partly closed as a result of the tipping of adjacent teeth. A tremendous additional and abnormal strain is placed on the peridental membrane attached to these teeth, and as clinical evidence shows that this supporting tissue has its limits of endurance to punishment, a large number of these teeth will be lost at an early age, in addition to the now missing first molars. The partial closure of forty-one spaces by bodily drifting in the bone of adjacent teeth without changing of their long axis does not influence the peridental membrane particularly, but a normal dental bridge cannot be placed. An undersized bridge may be constructed that is neither efficient nor satisfactory.

Considering in the same manner the twenty-three spaces of the missing first molar that are closed, it is found that six are closed by tipping of adjacent teeth, eight by drifting and nine by tipping and drifting. Fifteen of the twenty-three spaces, therefore, have been closed by the changing of the long axis of the adjacent teeth, and additional and abnormal occlusal strain has

been placed on their peridental membrane. As contacts have been established in this group, this strain is not so serious as in the previous group, and these teeth have the support of their adjacent fellows by contact.

Of the dentures studied, 21 per cent show spaces between teeth anterior to the missing molars. This has occurred by the tipping and drifting distally of the six anterior teeth and the bicuspids. (Figs. 3-5.)

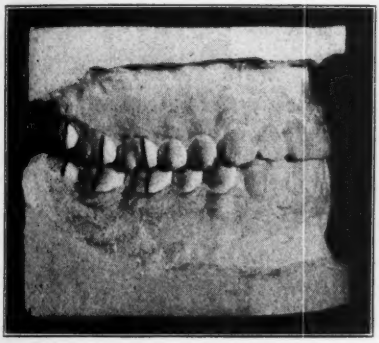

Fig. 1.—Occlusion; normal relation of the inclined planes when the jaws are closed.

Figure 1 shows the normal relation of the inclined planes of the teeth when the jaws are closed; namely, occlusion. It also shows, by the india ink markings on the buccal cusps of the upper molars and like markings on the buccal groove of the lower molars, the normal occlusal relation of the molars and normal relation of the long axis of the molars in respect to each other, and their relation to the denture as a whole, as well as their relation to the skull.

In selecting the illustrations, typical models were taken from the several groups studied to show some of the conditions described.

Figure 2, Model 8, taken from the group with one molar missing, shows that the space which should be occupied by the upper left first molar has been reduced to about three quarters of its mesiodistal diameter. This has resulted because of mesial drifting of the upper second and third molars and the distal drifting of the teeth anterior, which has produced an end-to-end relation of the upper lateral incisor with the lower cuspid, of the upper cuspid with the lower first bicuspid, of the

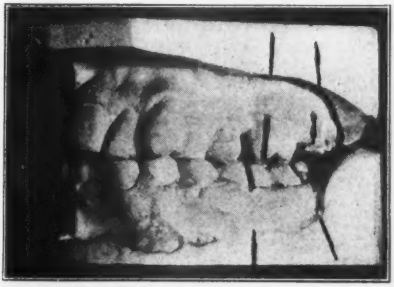

Fig. 2.—Model taken from the group with one molar missing.

upper first bicuspid with the lower second bicuspid and of the upper second bicuspid with the mesial cusp of the lower first molar.

The crowded condition of the anterior teeth has *not* been relieved by the extraction of the upper left first molar, as the upper left cuspid as shown in Figure 2 is still in buccal occlusion, and the upper left lateral incisor still has its distal angle rotated to the lingual. Also, the lower anterior teeth remain in their original crowded condition, which, in all probability, will be aggravated by the future eruption of a lower left third molar.

Figure 3, Model 3, taken from the group with three molars missing, shows the effects of the loss of the lower first permanent molar. The lower second and third molars have tipped mesially as indicated by the india ink markings (compare Figure 1). By this tipping, both inclined planes of the mesiobuccal cusp of the lower first molar and the distal inclined plane of the mesial cusp of the upper first molar have lost all occlusal contact. The mesial inclined plane of the mesiobuccal cusp of the upper first molar and the distal inclined plane of the buccal cusp of the upper second bicuspid have lost all occlusal contact because of the loss of the lower first molar. The corresponding inclined planes of the lingual cusps have also lost their occlusal contact. Figure 3 further illustrates the distal drifting of the lower bicuspids, which have drifted together, partially closing the space of the lost molar and opening a space between the lower right cuspid and the first bicuspid.

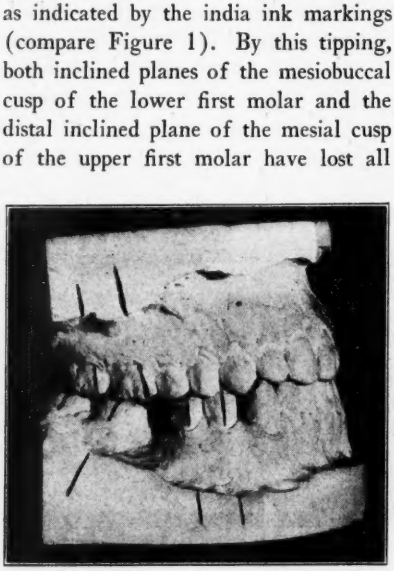

Fig. 3.—Model taken from the group with three molars missing.

Figure 4, Model 23, taken from the group with one lower molar missing, shows that, as a result of the loss of the lower first molar, the second and third lower molars have drifted mesially, as indicated by the india ink markings, (compare Figure 1) only one full cusp. Also, the lower second bicuspid has drifted distally to contact with the lower second molar, with a serious change of the long axis of the bicuspid. The lower first bicuspid has tipped distally, the lower left cuspid likewise, producing an end-to-end relation with their opposing fellows. In addition to the inclined planes of the lower first molar lost by the extraction, the distal inclined plane of the upper first bicuspid, the mesial inclined plane of the mesial cusp of the upper second bicuspid, the distal inclined plane of the lower first bicuspid and the mesial inclined plane of the lower second bicuspid are lost to occlusion.

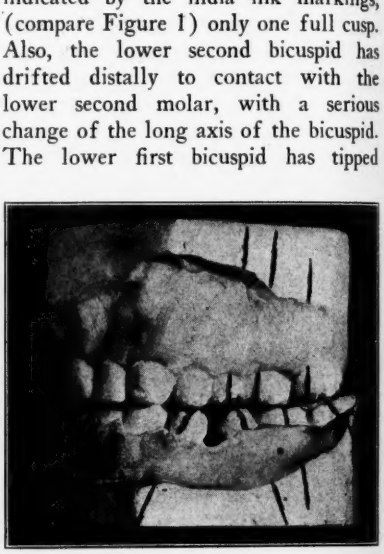

Fig. 4.—Model taken from the group with one lower molar missing.

Figure 5, Model 5, a right view taken from the group with two lower molars missing, illustrates the effects of the extraction of the lower first permanent

molar on the right side. The lower right second and third molars have tipped mesially, seriously changing the long axis of these teeth. The two lower bicuspids have tipped distally, opening spaces between the second and the first bicuspid and between the first bicuspid and the lower right cuspid. Spaces are also seen between the lower anterior teeth. The lower second bicuspid is also rotated one quarter on its axis. In the upper arch, the crown of the right second bicuspid is missing, but

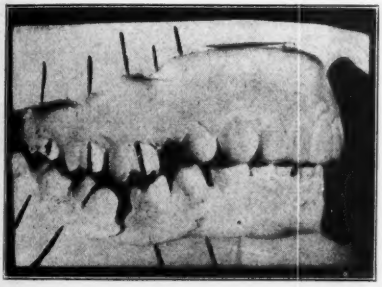

Fig. 5.—Model, right view, taken from the group with two lower molars missing.

the root is present and has been prepared for a post crown. The presence of the root and the evidence of recent dental work shows that this part of the mutilation is recent and has had no past influence in the malocclusion. The upper right first molar is decidedly in supraclusion, owing to the lack of occlusal resistance caused by the loss of the lower right molar, the tipping mesially of the lower second molar and the one quarter rotation of the lower second bicuspid.

The loss of occlusal contact on the right side of this denture because of the loss of the lower first molar is all of the lower second molars and the second bicuspids, as well as the extracted molar, all of the upper molar and the mesial inclines of the mesial cusp of the upper second molar.

Figure 6, Model 5, left view, shows the result of the loss of the lower left first molar. The lower second and third molars have tipped mesially, partly closing the space that should be occupied by the missing lower left first molar. The lower left cuspid and bicuspids have tipped distally, one full cusp producing a distal occlusion for these teeth, and the

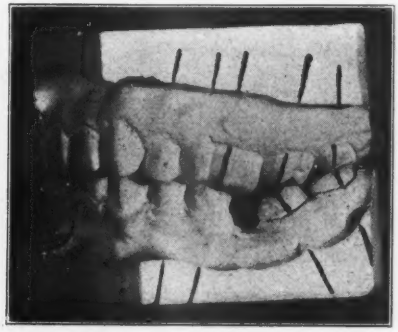

Fig. 6.—Model, left view, showing the result of the loss of the lower left first molar.

second bicuspid has rotated about one quarter on its axis. The upper left first molar has been mutilated by the poorly constructed gold shell crown, which is lacking in any effort toward restoring anatomic contour or occlusal surface. The loss of occlusal contact to the left side of this denture in addition to all of the missing lower first molar is of the distal half and all of the lingual surface of the upper left first molars, the mesial and distal inclined planes of the upper left second molar, the mesial inclined plane of the distal cusp, and the distal and mesial inclined planes of the

mesiobuccal cusp of the lower second molar.

Figure 7, right view of Model 6, taken from the group with four molars missing, shows the effect of the loss of the lower right first molar. The lower right second and third molars have tipped mesially, partially closing the lower first molar space. The lower right bicuspids have drifted distally a little, and the lower right second bicuspid has rotated about one quarter on its axis. Because of this rotation, the influence of the opposing inclined planes has caused the upper right second bicuspid to rotate about one eighth on its axis.

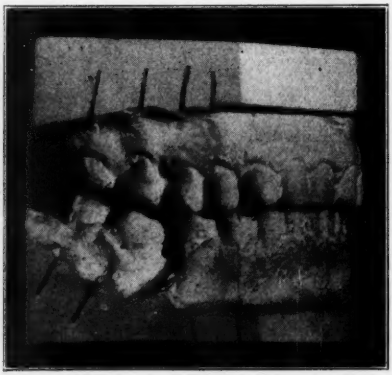

Fig. 7.—Right view of model taken from the group with four molars missing.

The loss of occlusal contact to the right half of this denture is of the lower right first molar, which is the one missing, practically all of the four right bicuspids, the mesial and distal inclines of the mesial cusps of the upper right first and the lower right second molars.

Figure 8, left view of Model 6, illustrates the effects of the loss of the lower left first molar. The lower left second and third molars have tipped and drifted mesially to contact with the lower left second bicuspid. By the change in the long axis of the lower left second molar by tipping and because of the deficiency in the normal proportion of the crown of the upper left second bicuspid, the loss in occlusal contact to this left side of the denture besides the missing molar is the distal incline of the buccal cusp of the lower left second bicuspid, the mesial incline of the mesiobuccal cusp of the lower left second molar; also both inclines of the upper left second bicuspid, which is not due to the loss of the molar, but does complicate the occlusion in this instance.

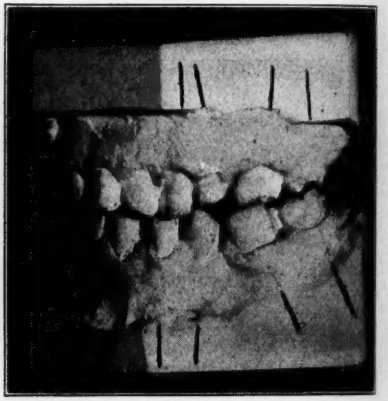

Fig. 8.—Left view of model illustrating the effects of the loss of the lower left first molar.

Figure 9, right view of Model 12, taken from the group with three molars missing, illustrates the effect of the loss of the upper right first molar. The upper right second and third molars have tipped and drifted mesially. The teeth anterior to the missing molar have all drifted distally, closing the space of

the missing molar and producing a mesial occlusion of the lower arch, a Class III malocclusion. The principal loss to occlusal relation is in the anterior teeth because of lack of normal overbite.

Figure 10, left view of Model 12, illustrates the effect of the loss of both left first permanent molars. The space of the upper left first molar is closed by the tipping and drifting of the upper left second molar and the distal drifting of all teeth anterior to it. The space of the lower left first molar is likewise closed by the mesial drifting and tipping of both the lower left second and third molars and the distal tipping of the lower left bicuspid. The change in long axis of these teeth is indicated by india ink markings on the cast. The angle of divergence is greater here than in the upper left teeth. The distal shifting of the upper six anterior teeth and the four upper bicuspids (compare Figure 9) shows that the effects of the extractions are bilateral and the result is a Class III malocclusion. It is important to note that the extraction of the lower left first molar has not counteracted this influence.

Figure 11, right view of Model 1, taken from the group with two lower molars missing, illustrates the effect of the extraction of the lower right first permanent molar. The lower right second and third molars have tipped and drifted mesially one full cusp. The lower right bicuspids and the anterior teeth have drifted lingually. This tipping and drifting of all the remaining lower teeth subsequent to the extraction of the lower right first molar has closed its space. The extreme angle of divergence of the long axis of the lower bicuspids and molars is again seen, as indicated by the india ink markings on the cast.

Figure 12, left view of Model 1, illustrates the effect of the loss of the lower left first permanent molar. The same reaction of the molars, bicuspids and anterior teeth is shown here as is illustrated and described in Figure 11, the opposite side of the denture. It is important to note that the shortening of the lower denture by the extraction of

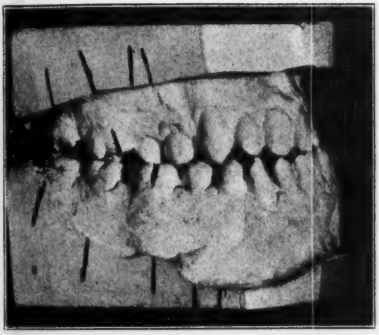

Fig. 9.—Right view of model taken from the group with three molars missing.

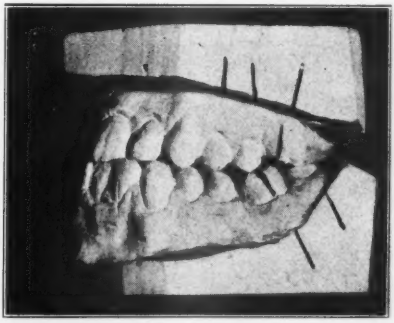

Fig. 10.—Left view of model illustrating the effect of the loss of both left first permanent molars.

the two lower first molars has caused the upper anterior teeth to become very irregular because of lack of normal resistance from the lower anterior teeth, which are quite regular.

The upper left cuspid is entirely in buccal occlusion, the upper left lateral is in lingual occlusion, the distal angle of the upper left central is rotated to the lingual and the distal angle of the upper right central is rotated to the labial. The upper long axis of the upper and lower right cuspids are in the same plane, which throws the upper right cuspid in buccal occlusion.

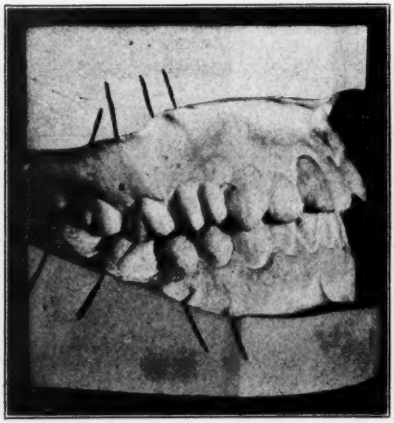

Fig. 11.—Model, right view, taken from the group with two lower molars missing.

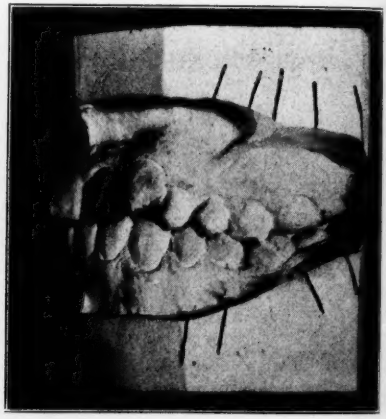

Fig. 12.—Left view of model showing the effect of the loss of the lower left first permanent molar.

CONCLUSIONS

As a result of this study, it is concluded that the loss of a first permanent molar is not an advantage to any denture. As a general principle, if one first molar is lost, it is not good practice to extract the corresponding molar in the same arch or to extract the remaining first molars. There may be rare instances when some such practice may seem advisable.

In a large proportion of dentures, the loss of one or more first molars, unless the spaces are promptly maintained by artificial substitutes, causes a shortening or narrowing or both narrowing and shortening of the denture, either by collapse of the arches or a failure in their normal development, if the denture has not reached its complete development. The malpositions of teeth are not corrected by the extraction of first molars, but, considering the denture in its entirety, the malpositions of teeth are increased.

The dentures represented in the 100 models studied are those of persons whose ages range from 18 to 30 years. In subjects so mature, it may be said that the malocclusion had reached the final stage of development as long as conditions were unchanged. However, occlusion or malocclusion at any age is

susceptible to any abnormal force. The loss of tooth substance, if it is not promptly and properly restored to normal anatomic proportions, injures any denture to the extent to which the normal relation of inclined planes is affected.

Most of the first molar spaces are partly closed by the tipping, drifting or tipping and drifting of adjacent teeth. In a few cases, the first molar space is closed. This is usually accomplished by the tipping of the second molar mesially and of the bicuspids and anterior teeth distally.

The change in the relation of the long axis of the tipped teeth places an additional and abnormal strain on the peridental membrane attached to those teeth. The open contacts in the anterior and bicuspid region of the dental arches, caused by the distal movement of these teeth resulting from the lost support of the missing molar, likewise places additional strain on the peridental membrane. Consequently, this tissue, being overtaxed, is more susceptible to trauma and to infection, and the packing of food against the gum tissue in the spaces produced by shifting teeth offers an increased opportunity for infection. The short life of such teeth is a matter of clinical history.

The masticating efficiency of the denture is decreased not only by the absence of the one, two, three or four molars but also by the tipping, drifting and rotating of other teeth, so that they are lost, partially or entirely, to occlusal contact.

All dentures examined indicate that the loss of the first permanent molar not only does not correct existing malocclusion but also aggravates it, and that the loss of the first permanent molar from a denture having occlusion induces malocclusion.

DISCUSSION

H. B. Singler, Springfield, Ill.: We have just heard the most scientific paper ever written on this subject, in my opinion. There remains little for me to discuss. Dr. Sippy has given considerable time and effort to collecting these data, which the average man would be a life time in acquiring. I myself am an example of the mischief which may follow the loss of the four first permanent molars, and I have precisely the trouble that Dr. Sippy has indicated. The extraction, in my case, was due to caries, and not for the correction of malocclusion. In my opinion, the first molars extracted for the relief of a crowded condition make up a very small percentage, but many are lost as the result of caries, mostly during grade school age. Dr. Seifert had occasion to examine employes of the Sangamo Meter Works and of thirty-nine examined, between the ages of 18 and 35, only two had all the first permanent molars. All the rest had lost one or more. Granting the fact that most of these first molars are lost through caries, the trouble begins not necessarily after the extraction, but during the period of decay, when, through fear of pain, the masticating is done on one side only. Now the movements of the teeth following the extraction may be divided into two groups: one in which the first permanent molars and incisors only are in occlusion, and the other in which the second molar or bicuspids or both are in occlusion. These may be subdivided again, according to the number of molars lost: (1) in regard to the movements of the teeth in relation to one another, when the force of occlusion is taken up entirely by the first molars; (2) in regard to the change in the relationship of the mandible and maxilla, when the force is distributed over the permanent teeth which are in occlusion, and (3) when the temporomandibular joint and bones of the face change. This usually occurs when the patient is younger and the bones are more susceptible to abnormal influence, which results in the deflection of the longitudinal axis of the skull and the general twisting of the bones. The articular surface of the temporal of the nonfunctioning side is higher than on the other.

The atrophied condition of the condyles in the temporomandibular joints is probably due to the functioning of masticatory muscles in elevating and depressing the mandible, thereby interfering with the symmetrical development of all the tissues of the face and skull. Dr. Sippy has given us a detailed description of the results of the drifting and tipping of the adjacent teeth, and I have tried to give you a few of the other results that accompany the loss of the first permanent molar. So far there has been very little written on this subject, which especially concerns the orthodontists.

E. E. Graham, Chicago, Ill.: Dr. Sippy has given us some sound working ideas which every dentist in the state might well adopt. I am frank to acknowledge my surprise at learning from Dr. Sippy's review of dental literature, if I have properly understood his statement, that there are an equal number for and against the extraction of the first permanent molars to regulate malocclusion by relieving the crowded conditions of the teeth in the arches. I knew we had a few men who thought and probably still think it advisable to extract the remaining three first molars if one is necessarily lost but I had no idea they numbered so many. It is my firm belief that it is practically never indicated. The slides we have reviewed would seem convincing evidence that no case ever again is normal after the removal of any one of the first permanent molars, and the abnormality only increases in proportion to the number removed. I have yet to see a normal occlusion when the second permanent molar had been coaxed into the place of the first. The inclined planes of the opposing teeth are certain to strike abnormally and produce a traumatic occlusion. When we realize there are more than 100 lateral surfaces of cusps, approximately fifty to be in proper relation to the fifty in the opposing arch, we must know that normal occlusion of the teeth is a delicate arrangement and easily disarranged. Dr. Sippy has, in his illustrations, pointed out the various positions the teeth take after the first molar is lost. He stated that out of 118 spaces partly closed, forty-four have resulted from the tipping of adjacent teeth and thirty-three from the tipping and drifting of adjacent teeth, which changes the long axis and produces peridental disturbance. The loss of any one of the permanent teeth after a time may indirectly affect the fitting of these inclined planes to each other. A one one-thousandth inch move or change of position may cause quite a concussion on the delicate investing membrane. It is not the slight immediate harm done that is of particular consequence, but the ill effects become a vicious circle, going from bad to worse. Dr. Sippy stated that the models studied were of patients between the ages of 18 and 30 years. In most of these cases, the really harmful effects have not yet been experienced by the patients. The existing condition favors an early loss of all the teeth, which might have otherwise been saved in a healthy condition. As I am thoroughly in sympathy with Dr. Sippy's attitude on this subject, what I would add would only be superfluous.

THE RELATION OF THE DENTOCEMENTAL JUNCTION TO PULP CANAL THERAPY*

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, California

ONE of the objections to pulp canal therapy is based upon the statement that there are channels of communication between dentin and cementum. It is argued that these channels not only serve to dilute any antiseptic placed in the canal, but also provide a means of entrance or exit for organisms to or from the peridental membrane through the cementum to the pulp canal, by way of the dentin tubules. It is this particular problem which I present for your consideration, and I propose to discuss it from several points of view.

1. The study of the histologic characteristics of dentin and cementum as shown in the ground-section.

2. The study of decalcified sections and a comparison of similar areas.

In the beginning, I wish to make it perfectly clear that this discussion includes only the question of the presence or absence of possible communicating channels. It is perfectly apparent that osmosis does exist in a tooth with a normal pulp or even in a tooth with an improperly filled pulp canal. If the proper precautions are taken in pulp canal filling, the property of osmosis may be destroyed, and the liability of this tooth to become infected subsequently from the pulp canal is reduced to a minimum.

If a brief review is made of the manner in which a tooth is formed, there will be found one outstanding fact that bears on this discussion; namely, that the dentin builds from without inward toward the pulp and that the cementum builds in the opposite direction, from within outward; that is, from the dentin toward the peridental membrane. Before any inorganic salts can be deposited in tooth structure, there must be laid down a fibrous network or reticulum designated as the organic matrix of dentin and of cementum. With this matrix clearly defined, the deposition of inorganic salts occurs about its fibers.

Most authors agree that the deposition of solid, inorganic portions of the tooth is made around the fine fibers of an organic matrix. For example, Noyes[1] states that the organic basis is formed first, and that "the inorganic salts are combined with it in a weak chemical union." Each tissue enamel-dentin and cementum—is formed within its own matrix, in a process that normally proceeds without interruption.

*Read before the Section on Anatomy, Physiology, Materia Medica and Therapeutics at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

1. Noyes, F. B.: Dental Histology and Embryology, Philadelphia, Lea and Febiger, 1912.

Mummery[2] and Von Ebner[3] have shown that this network in dentin is composed of a reticulum "of fine fibers of connective tissue, modified by calcification, and when that process is complete, entirely hidden by densely deposited lime salts." Finally, Hopewell-Smith[4] states that these fibers are identical to those found in bone, not only chemically, but also morphologically. He finds it impossible "to determine where the one begins and the other ends." Although he does not state the fact, it is not unlikely that the author just quoted referred more particularly to the study of calcified, rather than decalcified, sections.

When a ground-section of a developed tooth (Fig. 1) is prepared, several characteristic features of the root are demonstrable. One in particular is the granular layer of Tomes. On its periphery is a thin, clear layer of tissue with no evidence of the protoplasmic processes from the dentin tubules. This outermost structure is the cementum. Hopewell-Smith, Walkhoff and others refer to the fact that lacunae are absent in normal cementum; for normal cementum, instead of

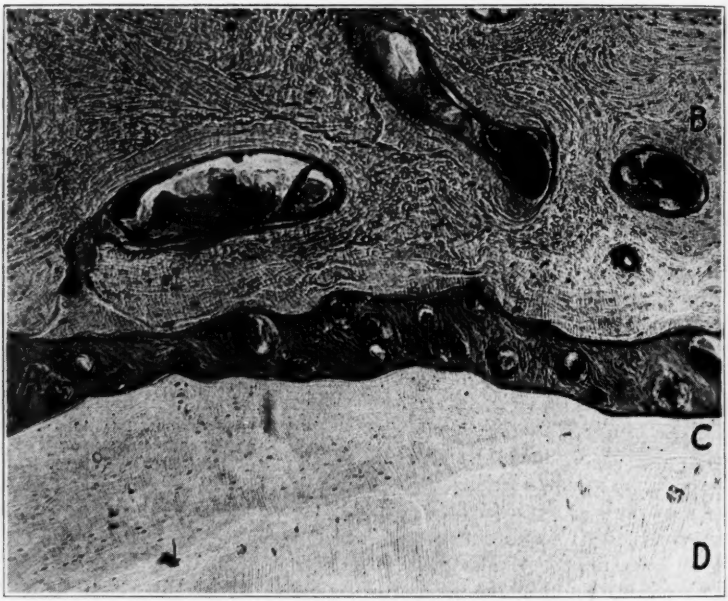

Fig. 1.—Ground cross-section of tooth showing peridental membrane (*A*), bone (*B*), cementum (*C*) and dentin (*D*), from normal mouth.

2. Mummery, J. H.: Philosophical Tr. Roy. Soc., 1892.

3. Von Ebner: Histology of the Teeth with Their Histogenesis, Schiff's Handb. d. Zahnheilk., Vienna, 1891.

4. Hopewell-Smith, Arthur: A Normal and Pathological Histology, Philadelphia, Blakiston's Son & Co., 1918.

consisting of lacunae and canaliculae, is made up of a "dense, solid, nearly homogenous band of calcified basis substance extending around the root." (Hopewell-Smith.) This tissue is laid down in a series of bands or lamellae. Furthermore, Hopewell-Smith regards about 22 years. The tissue for study was made available immediately after death and presents, so far as I am able to state at this time, the true picture of normal tooth structure, including the peridental membrane. These serial sections have been photographed and the

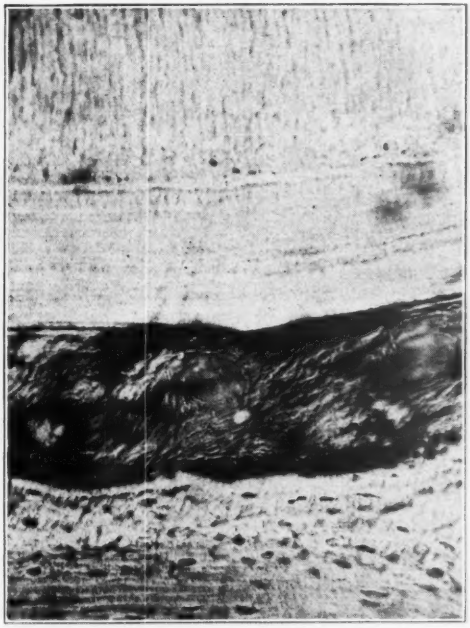

Fig. 2.—Section near the gingival fourth of the root of the specimen shown in Figure 1.

the presence of lacunae as an evidence of hyperplastic cementum rather than of normal cementum.[5]

I have prepared a series of ground-sections cut transversely from a normal cuspid perpendicular to its long axis. The individual from whom the material was obtained was a Mexican of particular points of interest will be emphasized later. (Figs. 2-4.)

When one examines teeth that have been decalcified in a manner described elsewhere,[6] changes in the specimens may be noted that are due to the solution of the lime salts. From certain observed peculiarities, it was decided

5. Hopewell-Smith, Arthur: J. Dent. Res., 2: 59, 1920. (Disc. xiii.)

6. Marshall, J. A.: Studies in Root Canal Sterilization, J.N.D.A., 8: 300 (April) 1921.

to determine to what extent decalcification affected the organic portion of the tooth. The original plan of the experiment was to compare a ground-section of a tooth with a section from a decalcified specimen, thereby observing the morphologic characteristics as they material is effected. The residue consists of the individual matrices, which preserve the general outline of the tooth. The size, of course, is quite considerably reduced, but the difference between the crown and root portion is readily recognized.

Fig. 3.—Section near the apical fourth of the root. The thickness of the peridental membrane as compared with that shown in Figures 2 and 4 may be noted.

may appear under the two methods of laboratory treatment. I have demonstrated that a separation can be made experimentally between the matrix of the dentin and that of the cementum, and that definite histologic differences exist between the two tissues.

When a fully developed, fully erupted tooth is subjected to the action of dilute acids (nitric or hydrochloric acid), a solution of the inorganic

The study of these structures demonstrates three points: (1) that the matrix of the dentin may be separated from the cementum; (2) that the fibers of the dentin matrix run in a different direction from the fibers of the cementum matrix; (3) that there is a slight difference in the size of the two matrices.

Figures 5 and 6 illustrate the progressive stages that may be followed in the removal of the outer tunic

of the cementum from the underlying dentin. In effecting this removal, a carefully graduated pressing and pulling motion must be applied so that the direction of the force is toward the apex of the tooth. The ease of removal depends entirely on the degree of the decalcification of the specimen. If the process has been of too long duration; if the acids used have been too strong, or if the temperature has not been controlled, the outer tunic becomes so friable that it breaks readily in the fingers. The matrix of the dentin, also, loses firmness, and fractures on the slightest pressure. On the other hand, if the decalcification has not proceeded to a sufficient degree, the calcium salts still remaining in the specimen make a separation of the two tissues very difficult.

The microscopic study of the tissues shows structural characteristics that are more pronounced in the sections than in the photographs. (Fig. 7.) The illustrations are sufficiently clear to indicate that there is a marked difference in the relative position of the fibers of the dentin matrix and those of the cementum matrix. (Fig. 8.) In the dentin, the fibers appear to emanate from the dento-cemental junction. In arrangement, they are analogous to the spokes of a wheel, except that the distance between the fibers is constant from the periphery toward the center. In other words, the fibers parallel each other, and this paral-

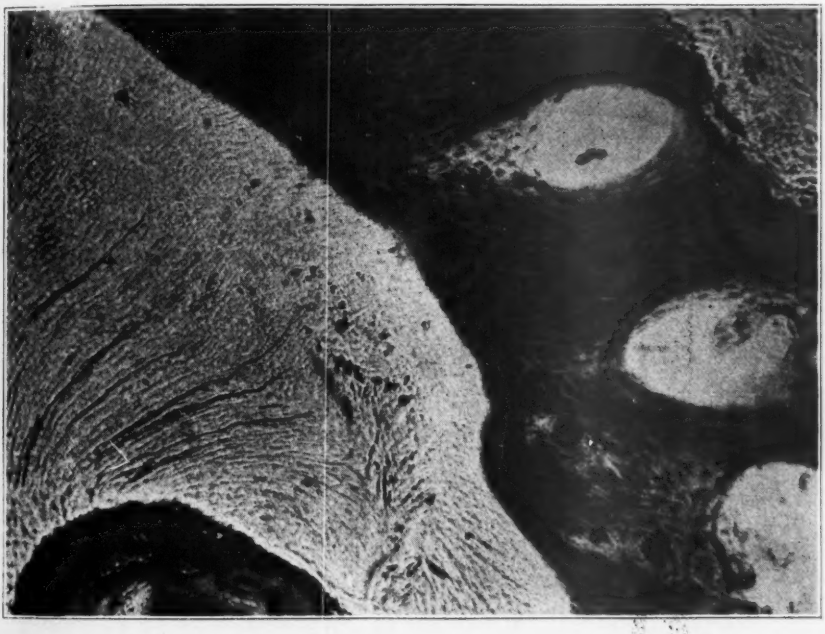

Fig. 4.—Section near the apical foramen. A small portion of the pulp canal is included. The cementum and peridental membrane are the predominating tissues.

lelism is due, apparently, to a complicated anastomosis. The fibers of the cementum present quite a different picture. In this case, they appear to run concentrically around the tooth, and in some sections are at right angles to those of the dentin, as shown in Figure 9.

The difference in size of the fibers is not quite so evident. However, in many instances, the spaces between them are greater in the cementum than in the dentin, (Fig. 10) giving the impression that the cementum fibers are larger. This difference in size is not constant, owing to the fact that so far it has not been found possible to bring all the different specimens to the same stage of decalcification. In some cases, the fine fibrous network is either partially disintegrated, which makes the spaces between the fibers larger, or else the decalcification has not been entirely completed and a portion of the inorganic material still remains. In the latter event, the spaces are in some instances indistinguishable. The extent to which the fibrous network may be destroyed is shown in Figure 11.

Fig. 5.—The first stage in the removal of the cementum matrix.

Fig. 6.—A decalcified central incisor showing the cementum matrix (right) separated from the dentin matrix (left).

In these experiments, it has not been possible to demonstrate the presence of intercommunicating channels between the fibers of the dentin and the cementum. The fibers appear entirely different, not only in the direction in which they run, but also in their relative size.

If, as has been assumed in the past, there are intercommunicating fibers, this connection would absolutely preclude the separation of the two tissues, for the communicating channels between the

dentin and the cementum would be due to the presence of interlacing fibers. Since this separation can be easily accomplished, it follows that the organic matrices of the dentin and of the cementum may be regarded as two distinct entities, histologically different and, with the exception of the apical foramen without channels of communication. There is even more direct evidence. When tissues are stained by the vacuum method, every opportunity is given for the stain to be carried through the dentin to the cementum. In this experiment, teeth with open and reamed pulp canals are fitted with a sprue, embedded in paraffin, and the opening to the sprue hole is covered with a dye. The paraffin block so prepared is then placed in a vacuum and exhausted for twenty-four hours. At the end of that time, the vacuum is released. The stain, placed over the apical foramen of the embedded tooth, is driven into the tubules by the force of the released vacuum. Even with young teeth, the stain is not carried through the dentin to the cementum. The channels of communication have not appeared.

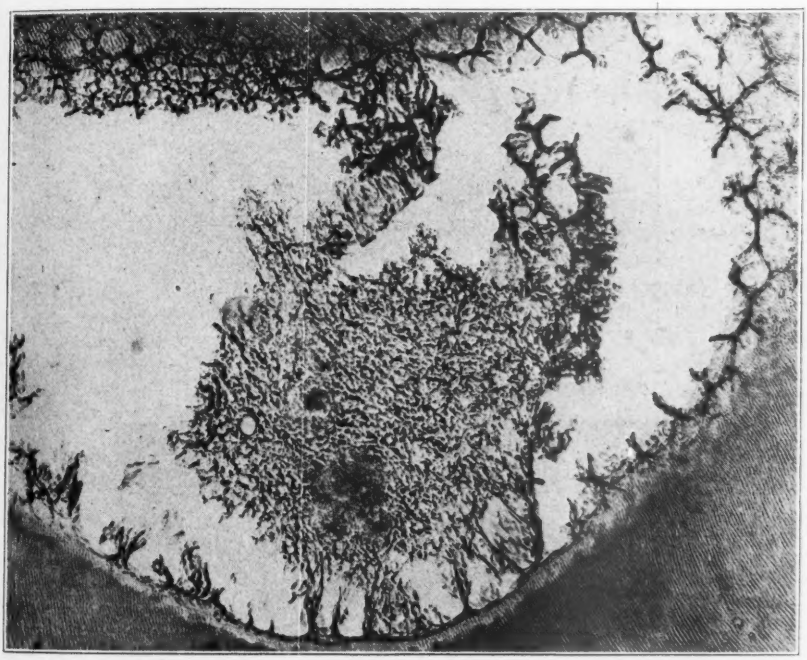

Fig. 7.—Cross-section of a portion of decalcified dentin matrix. The outline of the pulp canal and a portion of pulp tissue is shown.

This problem has been studied from another angle. Experiments have been performed with young animals in which

certain anilin dyes were injected under the skin and the dye was carried by the blood stream to different parts of the body. This is commonly known as a

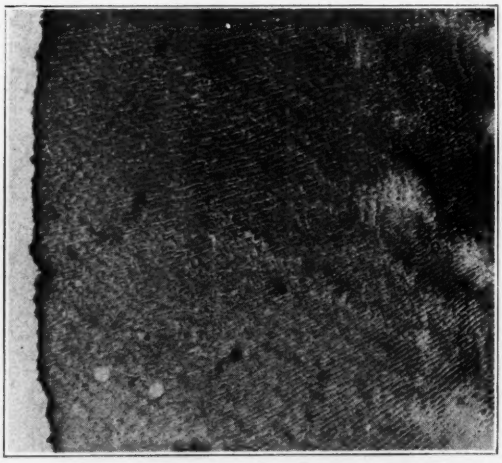

Fig. 8.—The periphery of the dentin matrix.

Fig. 9.—Decalcified dentin (*A*) and cementum (*B*). The difference in direction of the fibers may be noted.

method of "vital staining," and has been used by many investigators to determine the rate of growth of certain tissues.[7] When this procedure is carried out with rats, it has been found that enamel, dentin, cementum and pulp all exhibit characteristic reactions toward these vital stains. The point of particular interest at this time is this: When such teeth are examined microscopically, there has never been a single case found in which the vital stain has been carried through the dentin to the cementum.

Fig. 10.—Cross-section of a cementum matrix and an adjacent circumscribed chronic apical abscess.

A comparison of results of three totally different types of experiments performed at different laboratories shows that they all point to the same conclusion; namely, that channels of communication between dentin and cementum have not been satisfactorily demonstrated and probably do not exist except through the apical and accessory foramina.

The application of this to pulp canal therapy is, of course, obvious. Antiseptic dressings, when properly placed in a canal, do not find their way out of the dentin into the peridental membrane through any "holes in the tooth structure."

7. Marshall, J. S.: Dental Items of Interest, 42: 39-52 (Jan.) 1920.

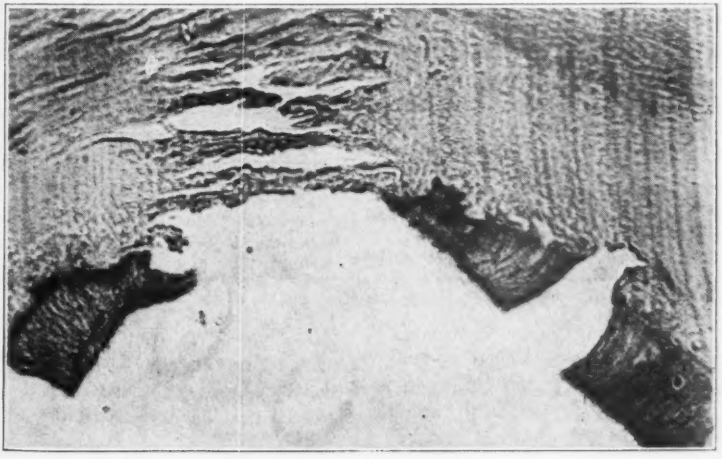

Fig. 11.—Partial disintegration of organic matrices.

That antiseptics are subject to osmosis is, of course, beyond cavil; but osmotic action is a force easily controlled, and since it may easily be controlled, it does not militate seriously against the success of pulp canal therapy. This fact is to be emphasized: the life of the tooth is dependent on the integrity of the peridental membrane, and not on the integrity of the pulp, and the relationship of pulpless teeth, properly treated, to the organism as a whole depends on this concept.

Callahan, when he developed his root canal technic with chlororosin, appreciated this fact, and his technic, slightly modified, has been found satisfactory in the root canal clinic at the University of California. During each fiscal year, about 1,000 teeth are treated and filled at the clinic, and these filled teeth are in many cases serving as bridge abutments. The technic of procedure is this: Prove the sterility of the pulp canal by bacteriologic test. Dry the canal thoroughly, using the method of J. Foster Flagg of more than sixty years ago. Having, and maintaining, a dry canal, varnish it and revarnish it with an excess of 10 per cent solution of violin bow rosin and thymol. Absorb the excess, apply the minimum amount of chloropercha and place the guttapercha points at the apex. These have been previously selected, not alone for length but also for circumference. You may ask, "How is one to measure the circumference of the apical foramen without extracting the tooth?" It is the simplest thing in the world. Select various sizes of pathfinder broaches and pulp canal pluggers. Beginning with the smallest, pass each one into the canal to the apex until one is found that will not go through. The circumference of that instrument is slightly greater than the circumference of the apical foramen, and the point should be selected accordingly. In packing the points, place them first the measured distance in the canal, warm them with warm air, and pack laterally with a small plugger. Then insert another point, warm it and pack, and continue placing more points until at the end of the operation a plugger cannot be forced through the substance of the filling.

The rosin solution applied in the first instance enters and occludes the dried tubules, thus effectually stopping osmosis. The chloropercha follows into the accessory foramina, and the filling is made solid by warm air and careful packing with cold instruments.

SIMPLIFIED RECORDS AND BOOKKEEPING OF AN ORTHODONTIST*

By C. W. B. WHEELER,† D.D.S., New York City

THE first year in orthodontic practice impressed me with the importance of records, and, as the years have passed, I have become more and more impressed with their importance. At first, I was inclined to make many notes, and if I had continued, by this time I would have had a mass of material, much of which would have been of little use to me or to others.

It is now about fifteen years since I became interested in record systems, and, after getting together the different ideas, commenced picking out what seemed to me the best; that is, the ones taking the least time, and being the most accurate.

In 1919, I had gotten far enough along that I felt it would be well to present what would possibly help someone else, and, for this reason, brought the information before the American Society of Orthodontists. In 1923, I had still further improved the system, and I read a paper in Chicago on the same subject.

Dr. Lischer read a paper[1] entitled "The Records of an Orthodontist," at St. Louis in 1919, which I believe it would pay any one to read. The conditions that existed then, to a great extent, exist today, and if others would give their attention to the problems involved, we would get ahead considerably faster.

To quote from Dr. Lischer:

> Orthodontics is of dental origin, was first matured by dental practitioners, and though it is a crowning achievement of the dental progress of the last generation, it is still in its infancy. And in the realm of the remedial arts, even dentistry itself has not yet attained that perfection and esteem which it merits.
>
> Our constitution declares: "The object of this society is to promote orthodontics as a science, and as a distinct dental specialty." Now it is obvious that every scientific advance that will strengthen the art as a specialty, ultimately, rests upon the service it renders to society at large.
>
> But if we reflect for a moment on the great number of facts which daily come under our observation, it appears doubtful whether we are taking advantage of our opportunities. I have already intimated that when we entered the ranks as specialists we assumed certain obligations; and one of the most important of these, it seems to me, is to record the great mass of facts which fill the routine of our daily tasks. Are we doing this to the best of our ability? I hesitate to answer because, unfortunately, I am compelled to say *no*.

In this short paper, I have tried to bring out all the important points about the system. If the orthodontist uses it rightly, he can obtain as many, or as few, facts in regard to his prac-

†Deceased.

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Lischer, B. E.: Internat. J. Orthodon., 1919.

tice, patients, treatment of cases, result, efficiency of appliances and other data can be kept accurately by an assistant, with no work on the part of the ortho-

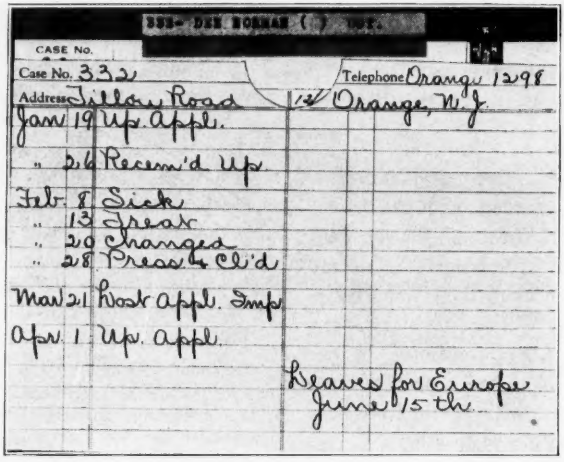

Fig. 1.—Consultation card.

as he wishes, without expenditure of time on his part, and the records will be as nearly accurate as is possible.

dontist, and the expenditure of less than two minutes of time by the assistant, at each visit of the patient.

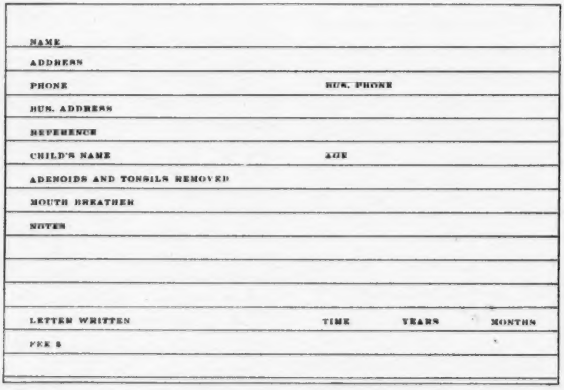

Fig. 2.—Ruled envelop.

I believe that I have succeeded in working out a system in which all data

The cards may be changed so as to take in other facts, or an extra card

may be added, but I think it best to ponder well before doing this as we are apt to record data that will be quate: consultation card; envelop and two cards; appointment book; ledger; expense book.

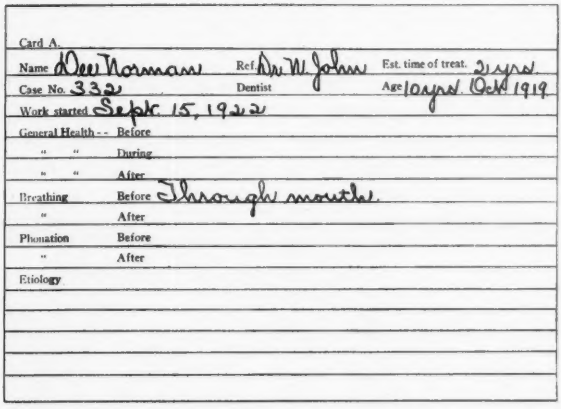
Card A.
Name Dee Norman Ref. Dr. W. John Est. time of treat. 2 yrs
Case No. 332 Dentist Age 10 yrs. Oct 1919
Work started Sept. 15, 1922
General Health -- Before
" " During
" " After
Breathing Before Through mouth.
" After
Phonation Before
" After
Etiology

Fig. 3.—Card A.

of no good to ourselves or anyone else, and only take the time of our assistant and occupy space in the filing cabinet.

1. The consultation card, which has been changed but little in the last ten years, is used for all patients who call

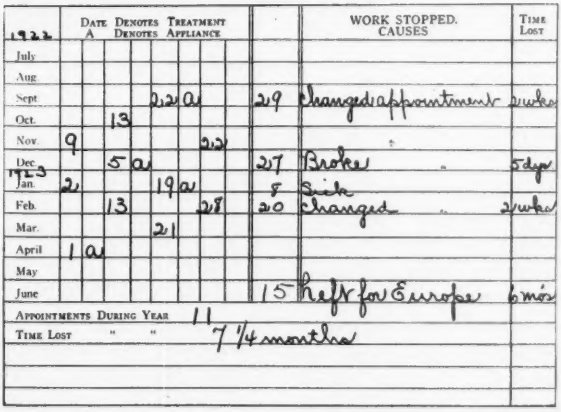
1922 | Date A Denotes Treatment Denotes Appliance | | WORK STOPPED. CAUSES | Time Lost
July
Aug.
Sept. 22 A 29 Changed appointment 2 wks
Oct. 13
Nov. 9 22
Dec. 5 A 27 Broke " 5 days
1923 Jan. 2 19 A 8 Sick
Feb. 13 28 20 Changed " 2 wks
Mar. 21
April 1 A
May
June 15 Left for Europe 6 mos
Appointments During Year 11
Time Lost " " 7 1/4 months

Fig. 4.—Reverse side of Card A.

At the present time, I am using the following cards, and I find them ade- to consult in regard to what can be done, time, etc. On this card are placed all

the data as well as the fee and estimated time of treatment. It is well to make a note of any accidents that the patient may have had in the past, in which the teeth have received a blow or have been injured, etc. A statement about such matters is readily given by the patient at this time. After the movement of the teeth commences, should trouble occur, it will be difficult sometimes to get a statement in regard to previous injury.

2. The record envelop, with cards, which has been constantly changed, is now in a form that I believe it will not be necessary to change, although many will probably wish to keep other data by adding something to this record.

A cheap, ruled envelop is used, and there is printed at the top a place for the address and telephone number and also the case number; the latter, so that there will be no chance of the envelops getting mixed. The envelops are made inexpensively so that there is no hesitancy in throwing them away when soiled.

Information is written on the envelop by the orthodontist or assistant while the patient is still in the chair. It should show exactly what has been done, also what he believes, at this time, that it will be necessary to do at the next visit. The latter data are written as briefly as possible, with only the words necessary to bring the idea back to the operator when he next glances at it.

In my hands, this often saves much time when I have not seen the patient for some weeks and the appointment is a short one. It brings back the situation as I saw it at the first visit, and I can readily see whether it is better to change the plan or carry it through. Of course, the note is often crossed off or erased after it has been used, and only what has really been done is left.

When the envelop is covered with writing or has become soiled, it is

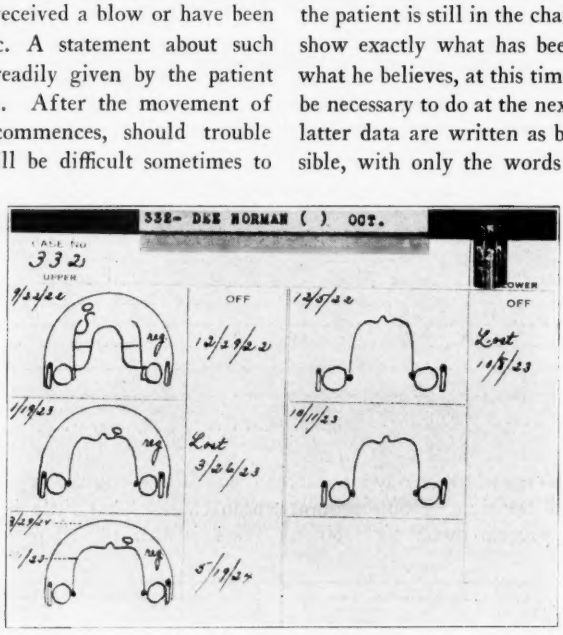

Fig. 5.—Appliance Card.

thrown away after the information thereon has been copied on a new one.

Inside the envelop is card A and the appliance card B. On one side, card A contains data in regard to the patient, such as when the work was started, who referred the case, age, operations, condition of the mouth and any other notes that will answer questions that may arise while the patient is in the chair. These facts can be obtained in a moment and often save considerable time and confusion.

track of the amount of time spent, I have found that, at the end of the year, the average is very close to the correct time.

If an orthodontist wished to give one patient fifteen minutes, another forty-five minutes and so on, it is a very simple matter to adopt a series of small checks, placing one check after the date when fifteen minutes was consumed, two for thirty minutes, etc., and adding them together at the end of the year.

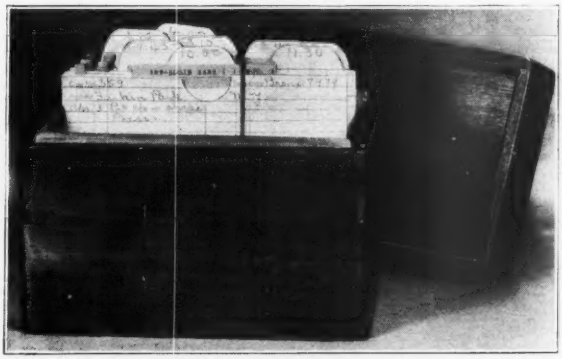

Fig. 6.—File for envelops.

On the other side are printed the months of the year, and then a series of columns, so that when a patient has called at the office, it is only necessary to write the number corresponding to the date of the month in the column.

If the operator allows the same length of time for each appointment, just at a glance, at the end of the year, he can tell the number of visits and the amount of time consumed.

I try to give each patient a half hour, but find that I sometimes work over the thirty minutes, and possibly the next time under, but, having kept careful

Then there is a larger column, and when an appointment has been changed or broken, the date is written here. There is a space for explanations and time lost through broken appointments, sickness, vacations or other reasons for staying away from the office.

At the bottom of the card, lines are left for summing up and other notes. Often a question comes up as to the progress of the work, and there is great satisfaction in handing the card to the patient, especially if the complaint is that the work is not progressing rapidly enough, allowing them to read for

themselves the number of changed and broken appointments, and the time thus lost. This often changes the whole aspect of affairs and puts the patient in the wrong.

Card B is the appliance card, and at the top is a long hollow celluloid tag in which a slip of paper is placed, bearing the case number, name, classification of case, and information as to when the patient should report to his dentist, and whether radiograms are on file.

the kind, the number, and the extent of time used.

At the end of the treatment, by studying this diagram, with the other data, we can find which appliance has been the most efficient and which a failure, also the number used and their cost.

I have found few men who have any idea about the number of hours consumed during the treatment of any one

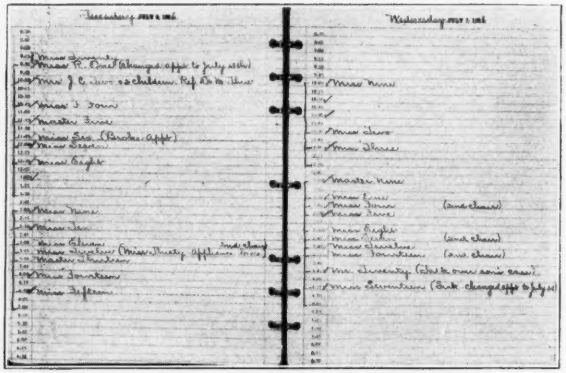

Fig. 7.—Appointment book.

There are six spaces on each side of this card, on which the assistant draws diagrams of the exact appliance put in the mouth and the date when so placed. This is done while the patient is still in the chair, and the orthodontist is busy working on something in the mouth. In this way, there is little danger of error.

If an appliance or part of one is removed, a light line is drawn from it to the column marked *off*, and the date placed there. In this way, we have a complete record for every appliance, of

of the classes of malocclusion or appliances used.

If they do not know this, how are they to draw a satisfactory conclusion as to what fee should be charged if the patient asks for an estimate in advance?

I believe the reason that this is not known is because most men dread the amount of labor involved in a tabulation of it.

This undue expenditure of time I have tried to do away with, and, at the present time, it means with me but a few strokes of the pen.

For a number of years, I have kept

an accurate record of the time spent on every patient. By taking twenty-five or more cases from any one type of malocclusion, and getting an average of the time consumed, I can come very close to knowing how long it will take for the completion of a given case. This arrangement also gives us valuable information in regard to time of retention.

resort to many schemes, such as a second appointment book or a small list made out for the day and slipped in the drawer, etc.

To cover this point, I have my secretary take her appointment book and pick out from the file the envelops of patients coming in the next day.

Into these envelops are slipped index cards with hours on which the patient is

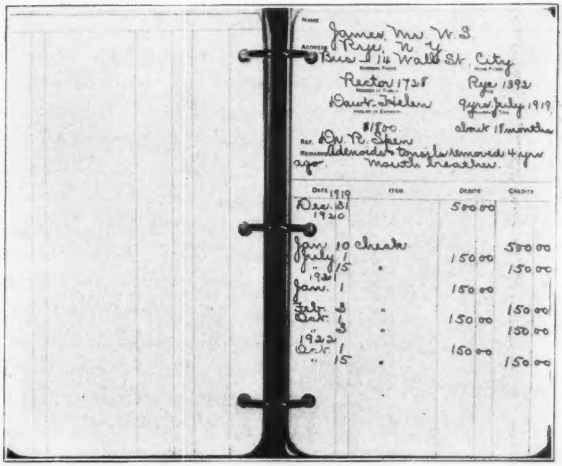

Fig. 8.—Ledger.

In using the cards for a daily appointment list, I still follow my old plan and I quote from my earlier paper:

> In a busy practice many things slip your mind and to me it is embarrassing for the patient to ask about a radiograph, photograph or something else taken months before, to find my mind blank on the subject, and get the assistant or secretary to look it up.

I have found that a great many men have their secretary in another room. It is not convenient to keep in touch with her in regard to the next appointment, and the amount of time to be allowed the patient in the chair, so they coming in, marked plainly on the extension. Three sets or more of these index cards should be kept on hand with the time marked on them in this manner: 9.00—9.15—9.30—9.45—10.00, and so on until the closing hour. If they are made up and kept on hand, it is an easy matter to slip them into an envelop. Early the next morning, the envelop, with the time cards in place, are put in a small file on the operator's table.

In this way, the time for each appointment can be seen very readily and the amount of time that has

been allowed. When the patient is seated, the assistant takes the card out of the file and lays it on the table before the operator. All data is then at hand.

In one of the drawers in my operating table I keep a number of small metal tabs of four different colors, and as the patient leaves the chair, my assistant slips one on his envelop. A blue tab means a regular appointment, so I can see a patient in each chair, as I have two. A red tab means a regular appointment, but that I must give the patient the entire time and must not be interrupted by another patient. A black tab means that a longer interval is to elapse between visits than is usual. A green tab means that the patient is only under observation and comes in but two or three times during the year.

As the envelop is handed to the secretary she will know all about the next appointment from the color of the tab. When the envelops are placed in the file the tabs will stand up, and by counting the different colors, you can tell in a moment the number of active and inactive cases in your practice.

APPOINTMENT BOOK

The appointment book is very little different from those in universal use. It is, however, divided into quarter hours, and should not be of the loose leaf variety, although I use this form. If a question of law comes up, a loose-leaf book is sometimes not accepted.

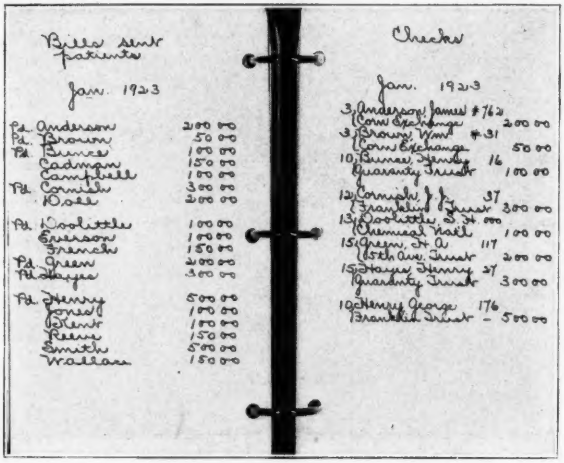

Fig. 9.—Ledger.

This book shows the amount of time consumed by a patient, and even if appointments have been changed or broken, we have a complete record.

Before the name of each patient, a colored check is made with a pencil, which corresponds with the color of the tabs on the envelops. This gives us at a glance the importance of an appointment when making others.

LEDGER

The ledger I have not changed. At the top of the page are given data that will help in sending bills. Below are the customary debits and credits.

In the back of the ledger, the first of each month, the operator makes out a list of the patients to whom bills are to be sent and the amount. This is all that he has to do with this part of the work. This seems necessary because only he knows the condition of the patient's mouth and the amount of work that has been accomplished. The payment of these bills, either by check or cash, is entered on the opposite page.

With the checks the maker's name is given, the amount, date, number and the bank on which it is drawn. This gives us a complete record. If any inquiry arises at any time, we can give all these data. It often settles a question in itself when it is known that we have an accurate business-like method of keeping account of all checks. From this list, at the end of the month, the ledger can be posted. I believe it best to keep the financial record separate from other records, as it may be necessary to consult the latter at any time before the dentist, physician or others not interested in the fee.

EXPENSE BOOK

There are many expense books on the market that will cover this part of the record, and if one is obtained that contains a number of columns that can be used under headings, such as: rent, gold and appliances, it will prove very satisfactory.

The radiograms are, of course, filed, so that we can readily get at them, and also our photographs, and with our models of the case on hand, we should be able to get, at a very short notice, with small expenditure of time on our part, an abundance of data that should be extremely valuable to us as well as to others who are engaged in research work or others who are trying to forward our speciality.

DISCUSSION

O. W. Brandhorst, St. Louis, Mo.: The gathering of data regarding cases is frequently the most neglected side of our practice. While only basic principles have been outlined here, it is hoped that more detail will be given in some form or other, showing their application. With many of us, the keeping of records is a huge task; while others tend to "live" in it. Sooner or later, we all reach the place where our time must be conserved, and any system of record keeping, besides being absolutely accurate, must also be simple enough so that it can be readily cared for by the assistant or secretary. The consultation card of which Dr. Wheeler speaks is, without doubt, an essential part of an accurate system and can be enlarged on at will. The recording of the conditions present at the time of consultation, the information regarding accidents, the discussion of fees, etc., all this is important information that should be recorded. The use of the envelop and cards is a rather unique idea and by its use one will gather much valuable data. Personally, I do not use them, but combine a loose-leaf record chart with the appointment book (not loose-leaf) to gather the same information. I find that treatment, etc., can be readily recorded and future plans outlined on the arranging of the next appointment. I do not believe that this requires any more time on my part than would the envelop and card system. Broken appointments are recorded in red and therefore become rather conspicuous to anyone glancing over the chart. For many of these methods, I am indebted to Dr. Lischer. A great advantage in having these charts placed before you each time is that it refreshes your mem-

ory on your plans and probably makes for a greater effort on your part to keep things progressing. The appointment book becomes a sort of day-book, and most of us use it in some form. It is absolutely necessary, and its usefulness, aside from recording the appointments, becomes an individual matter. The ledger also is a necessary adjunct to a complete system and is used by all in some form or another. The expense book, of which Dr. Wheeler speaks, should really be more than a record of expense. What good is there in recording the time required for an operation, individual receipts, expenditures, etc., unless we have some way of correlating these facts simply yet accurately, so as to make all information available at all time. This expense book should really become a balance sheet for our practice and tell us at a glance the source of income, expenditures and balance. Since the United States government now demands the keeping of accurate records as to one's net income, this expense book should be so arranged as to make it easy to get the information necessary. Dr. Wheeler says little about other records, such as case histories and the mass of information accumulating from this source. No doubt all this is duly recorded and cared for. But it does little good to record detailed information regarding an individual case unless, by indexing and cross-indexing, we correlate the information from a huge number of cases and make it mean something more than mere form. Record keeping, therefore, is not necessariiy a hobby of an individual; at least, it should not be. It should be an indispensable part of every man's practice.

TREATMENT OF HEMORRHAGE*

By GUY L. HAMAN, D.D.S., Reading, Pennsylvania

TO a body of men specializing in our field of endeavor, one would at once see that a rehash of accepted treatments for bleeding as used in the hands of the general practitioner would be adding insult to injury. Therefore, I have prepared an outline that would more nearly commend itself to the surgeon faced with the grave responsibility of combating a case of purpura hemorrhagica or uncontrollable hemophilia.

This is a statement none too strong, for even though the majority of cases take care of themselves nicely or are readily controlled by simple means, it is the occasional unexpected one out of the 100 that taxes all our energy and exhausts all available knowledge of the healing arts.

It is important, but not always practical, to get a case history or a complete report of the blood picture. The true hemophilic invariably knows his condition only too well and is anxious that we know it; whereas, a leukemia or purpura may be present unknown to the patient or operator, and from such a case, we have the most trouble.

A search of the literature has brought little that has been helpful in hemophilia. All the therapy developed in recent years, the use of which is so helpful in emergency treatment, is acknowledged to be of brief effect. That there is no known permanent cure is also acknowledged.

*Read before the American Society of Oral Surgeons and Exodontists, Philadelphia, Pa., Aug. 20, 1926.

Determination of the coagulation time is, in many cases, valuable, but cannot be relied on entirely; for in hemogenia or pseudohemophilia, the coagulation time is normal but the bleeding time is extremely long. Exposure of the area over the spleen to the roentgen ray in these cases has reduced the bleeding time from 105 to thirty-five minutes the first day and on the fourth day to three minutes. This therapy brings to light the fact that the structure of the vessels as well as the blood condition is at fault. The favorable action of the roentgen rays may be ascribed to their distinct influence on the endothelial cells of the vessels, since these cells are a part of the system to which the reticular tissue of the spleen belongs.

An interesting but untried theory has been advanced: Hemophilia slips the female link in transmission; therefore, the logical sex hormone that distinguishes the ovarian extract of the cow may be used as an adjunct to heliotherapy and shock treatment.

The injection of blood probably owes its efficacy to protein shock, which may be the explanation of the beneficial effect of roentgen-ray radiation and ultraviolet radiation of the spleen with a quartz lamp, and injection of the patient's own blood.

Everything points to the assumption that hemophilia is due to the occasional or periodic formation of a substance that damages the vessels, this accounting for the waves of more or less pronounced preparedness for hemorrhages. Instances are known in which a change to a mountain or tropical climate has arrested this tendency. The influence of the actinic sun ray may be responsible for this, as the skin of bleeders seems to be abnormally delicate.

In leukemia, we are faced with the gravest responsibility, as these cases invariably end fatally after running a short, rapid course. Most of the cases of leukemia that we see are diagnosed after the extraction of a tooth is followed by a hemorrhage. Acute leukemia is a disease of the blood-forming organs, of unknown etiology, running a short, fatal course. The onset may be sudden, and is then usually hastened by some operation, such as the extraction of a tooth; or it may be insidious.

The first symptoms, which may precede the disease by several weeks or months, consists of general weakness, indefinite pains in the head and jaws or teeth; or other vague disturbances. Frequently, puffiness of the face, accompanied by palor or anemia is noticed, associated with an inflammatory condition of the mucous membranes of the mouth, especially of the gums and throat. Hemorrhages in the mucous membranes in intact areas or in areas swollen with lymphoid cells may appear anywhere in the mouth. The gums may be swollen and grow over the teeth, completely covering them at times, and the teeth loosen.

Any attempt to cover hemorrhage of the mouth, with special reference to postoperative complications, without reference to the possibility of leukemia being the complicating factor would certainly be most incomplete; yet it may be timely to remark on the surprisingly few references to be found in our literature on this subject. Only last winter, I was spared the labor of blundering into a referred case by the short fatal termination of what had appeared to be a pyorrhetic bleeding in

the molar region, of a spontaneous nature, jumping from one interdental space to another without any apparent cause and not responding to any systemic or local treatment on the part of either physician or dentist.

From this can be seen the importance of (1) a whole mouth examination (hard and soft parts); (2) careful case history; (3) pain from systemic causes as well as dental causes, simultaneously; (4) bleeding gums, which may warn us of systemic diseases such as Vincent's infection, rickets, scurvy, mercurial stomatitis and leukemia.

When the case history or our better judgment warns us of bleeding, the wisest procedure by far is to make use of a preoperative prophylactic treatment, the most common method being the administration of calcium lactate, 15 grains a day or, in severe cases, 15 grains every four hours, for two to three days before the operation. Calcium chlorid is used also. These drugs act very nicely in many cases, but are by no means a cure-all, having absolutely no effect in some cases. Preoperative measures should be used to minimize the loss of blood at the time of operation. Control of hemorrhage to conserve the blood volume should always be considered in planning the technic of the operation.

When internal systemic medication is of no avail, the stimulating influence of the ultraviolet quartz lamp on the blood platelets in cases of purpura hemorrhagica and leukemia has been so noticeable in the building up of the platelet count that the preoperative prophylactic preparation of patients showing a bleeding diathesis has more than justified the use of the lamp. It is the rare or occasional case that gives us the greatest cause for alarm, and any agent in our hands that has been found beneficial should be used.

When preoperative prophylactic treatment has not been available or effective, we are compelled to resort to different methods. In primary hemorrhage, a compress of gauze saturated with epinephrin suffices. The wound should be free of all spicules of bone and other débris, the edges smoothed down and the gum flap sutured over wherever possible. Should the bleeding be persistent and of greater intensity than is usual from capillary oozing 5 drops of epinephrin in 10 c.c. of physiologic sodium chlorid solution may be injected in the mucous membrane.

Blood serum, preferably human, or rabbit or horse, may be applied topically or injected. The serum must be nonhemolytic to hemophilic blood and should be fresh. Antidiphtheric serum may be used, one or two injections daily. As serum ages, the thrombin changes to an inactive metathrombin. Serum 2 weeks old is not so effective as fresh serum. Commercial serum is usually from 6 weeks to 6 months old. Serum treatment is giving way to whole blood transfusion, which is a relatively simpler procedure, and, in addition, does not have the disadvantage of bringing on a possible anaphylaxis due to the injection of relatively large quantities of foreign proteins, which have nothing to do with the coagulability of the blood.

A few drops of the operator's or the assistant's blood (it being known that the donor is free from syphilis), if placed on the bleeding area, will often give immediately a satisfactory result.

Kephalin, or cephalin, which is prac-

tically identical with thromboplastin, being a suspension of brain tissue in physiologic sodium chlorid solution, with 0.3 per cent tricresol added as a preservative and antiseptic, will answer in many cases.

Coagulen, 5 to 10 per cent, must be prepared fresh. It is a yellowish granular powder of slight odor and sweet taste, and readily soluble in water and physiologic sodium chlorid solution, and, when dissolved, may be sterilized by boiling for two minutes, without destroying its coagulating properties. Simple in application, without appreciable effect on blood pressure and innocuous to the tissues, it may be applied hypodermically or intravenously to prevent secondary hemorrhage. In pronounced hemophilia, hypodermic injections of from 20 to 50 c.c. of a 3.5 per cent solution have proved satisfactory as a prophylactic.

Secondary hemorrhage presents an added and special difficulty, in that the vessels involved may be very friable or held in a dense infected inflammatory mass.

There are times when lateral digital pressure on the plates, plus compression, is not sufficient. A modeling compound tray or splint lined with cotton soaked in epinephrin may be used to advantage. Pressure on the mandible must be maintained, if necessary, with a Barton bandage, or the pack held on by ligating to teeth or suturing to adjacent tissues. I endeavor to avoid packing the socket as the socket is then protected better against infection. The bleeding is enough to contend with without a dry socket in addition.

There are on the market a number of excellent clotting agents in ampules that are very handy to use and obviate the preparation of any time-consuming formula. One of the most recent is administered by mouth in ice water on an empty stomach. This causes the clot formation at the site of bleeding within fifteen minutes, and is the only agent that should be administered at a reduced temperature. The other coagulating agencies are more efficacious when used at 37.5 C., or at slightly higher than body temperature. The wound itself should be kept at this temperature.

Whole blood for either transfusion or injection that is kept fluid by the addition of oxylates or citrates is not so effective as fresh blood.

DISCUSSION

L. Biddle Duffield, Philadelphia, Pa.: As Dr. Haman has said, the most important thing is careful examination of the patient, and, knowing that we have such cases, we put them under a treatment of calcium lactate, 20 grains, five times daily for three days. We extract not more than two teeth at a sitting, and then allow the patient to rest for a while, and if there is profuse bleeding, we sterilize the socket as well as possible and make up a mixture of plaster of Paris and epinephrin chlorid and, rolling a cone of cotton that will fill the socket comfortably, mascerate it in the plaster of Paris and epinephrin chlorid; then swab out the socket, and insert and hold the cone of cotton in firmly with the thumb and finger until the plaster of Paris sets. It is true that we do have some pain, but this can be helped by an ice bag. We find, after twenty-four hours, that the action of saliva on the cotton plug and plaster of Paris has dissolved it out to a certain extent, and it can be removed without secondary hemorrhage. We then give postoperative treatments to the socket. There are a few cases in which dry socket prevails, but this occurs in many ordinary extractions, and is treated accordingly.

WAX PATTERN AND CASTING*

By R. H. VOLLAND, D.D.S., M.D., F.A.C.D., Iowa City, Iowa

THE market affords a large selection of inlay or casting waxes of varying composition. The composition determines the characteristics of each brand or variety of wax. The color, hardness, melting point, plasticity, ease of carving, welding, etc., are minor characteristics and have little to do with the making of an acceptable wax pattern except as they appeal to the individual operator. But there are three basic properties, namely, expansion on heating, contraction on cooling and elasticity, that are common to all waxes and are of prime interest to the operator because of the recognition and treatment of these *three* properties determine to a large degree the perfection and stability of the completed wax pattern.

All waxes expand on heating and contract on cooling. Various types show slightly different ranges of movement under a given temperature change.

While wax is subjected to a constant temperature, the molecules arrange themselves so that they are comfortable and the wax remains passive. On changing this temperature, the relation of the molecules becomes disturbed and expansion or contraction takes place, depending on the direction of movement of the temperature. This disturbance among the molecules continues until they again reach a stabilized or comfortable arrangement, where they remain as long as the wax is subjected to the same temperature. If the wax is returned to the original temperature, the molecules make an attempt to rearrange themselves as they were originally, but the original arrangement is never fully accomplished, and the wax remains permanently slightly larger or slightly smaller as long as it is exposed to the original constant temperature.

So it is well to bear in mind that not only does wax expand on heating and contract on cooling, but also that the reaction is never quite equal to the original movement.

It is not difficult to determine the coefficient of expansion and of contraction of a given wax. The problem of expansion and contraction might be dealt with on a coefficiency basis if the wax in a pattern were evenly distributed, of a regular geometric form and uniformly warmed and cooled. But none of these conditions prevail, and the operator must depend on some other means of insuring adaptation and a stable pattern. As a general rule, neutralization of expansion and contraction can be efficiently accomplished, if, in the original adaptation, wax is used that

*Read before the Chicago Dental Society, Oct. 19, 1926.

is just plastic enough to insure, under strong pressure, a close adaptation to the details of the cavity, and if, as the wax cools and contraction takes place, readaptation under pressure is repeated until the final adaptation is made when the wax is just barely plastic.

All waxes are elastic. Some waxes are practically brittle at room temperature, but all show elasticity when warmed slightly. The compressing or bending of wax disturbs the relation of the molecules and puts them under a strain or tension. They have a tendency to assume their original relations and therefore the wax has a tendency to assume its original form. The elasticity is less if the force is maintained until the wax takes on the surrounding temperature and that temperature is maintained. This property of wax is known as "elasticity lock." It also follows that the elasticity may be locked by the application of cold while the wax is under bending or compression strain. In both cases, heat will release the molecular tension, and accelerated movement will occur. The more extreme the temperature change, up to the melting point, the more rapid and extreme the movement.

The temperature at which the locking of the elasticity occurs varies with different specimens of wax. Likewise, the temperature that is necessary to release the elasticity lock varies. As a general rule, waxes that have the least elasticity at room temperature carry the highest elasticity lock and require a correspondingly higher temperature to release. In making a wax pattern, the elasticity may be practically dissipated by the application of sufficient heat to permit the molecules of wax to rearrange themselves and become fixed and comfortable while the wax is under more or less continuous pressure. To accomplish this, some operators use an instrument that has been sufficiently warmed to melt its way through the wax after its initial adaptation. This method is likely to cause excessive expansion and contraction in the pattern, especially in the melted areas, and to necessitate considerable manipulation of practically all of the wax in the cavity to insure readaptation. The elasticity is effectually dissipated by bathing the adapted wax with a liberal amount of water at from 110 to 115 F. This method also causes some degree of expansion, later followed by some contraction, but only a slight amount of manipulation is necessary in order to correct the adaptation. The areas of strain developed during this secondary adaptation are so small and so widely distributed that their effect on the pattern is negligible, except, possibly, when the pattern is left uninvested for a long time, when warpage and distortion may occur.

As previously stated, there are many types of inlay wax and each brand has its advocates, usually because of some of the previously named minor qualities, but good patterns are made from a standard casting wax only when the operator recognizes and successfully treats the fundamental physical characteristics common to all waxes, namely expansion, contraction and elasticity. Therefore, any good inlay wax is sufficient, the important consideration being that the operator become familiar with its working qualities.

With the physical characteristics of wax in mind, a definite rational technic of making wax patterns for each class of cavities should be worked out and followed by each operator. This method should insure not only the adaptation of the wax to the walls and margins of the cavity but also the maintenance of that adaptation, and will make for speed and accuracy on the part of the operator. A selection of instruments should be chosen sufficiently

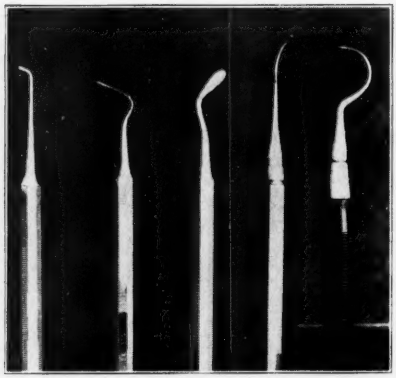

Fig. 1.—Left to right: (1) S. U. plastic No. 2; (2) and (3) working ends of Ward's wax carver; (4) explorer No. 2; (5) explorer No. 23.

varied in form and purpose that all shaping and polishing can be done in such a manner as continually to adapt and to maintain adaptation. Each operator has his own "pet" group. I show a group of four which seem to be well suited to follow out the principles of technic that I advocate. (Fig. 1.) In addition to these steel instruments, sewing silk, size "A" and tracing cloth or china silk strips are used. (Fig. 2.) The sewing silk is used to pass between the wax pattern and the adjacent tooth in order to free the contact point. If the silk thread is held tense, it will cut freely without any drag or pull on the

Fig. 2.—Tracing cloth strips and "A" sewing silk thread.

wax. Because of this fact, it can be made to assist in removing the surplus wax in the interproximal space by sweeping it in an occlusogingival or incisogingival direction, taking off a thin shaving at each sweep. The ordinary floss is so heavy that it is likely to drag

Fig. 3.—Glass containing water (110 to 115 degrees), with all-metal self-filling syringe.

or stretch a pattern. The tracing cloth or china silk strips are used to polish proximal surfaces of patterns.

Water at from 110 to 115 F. and a metal syringe are used to bathe the adapted wax in an effort to dissipate the elasticity and, incidentally, to wash away chips. (Fig. 3.)

The description of making a pattern for a mesiocclusal cavity in an upper second bicuspid will illustrate steps in the technic of patterns, and the rules thus illustrated can be easily applied to other classes of cavities. (Fig. 4.)

A generous sized piece of wax should be selected and the end gradually warmed by rotating it above a flame.

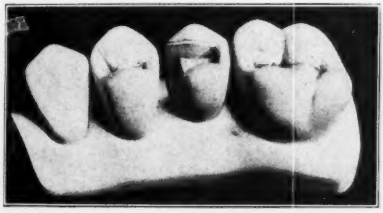

Fig. 4.—Mesio-occlusal cavity in upper second bicuspid.

Care should be taken not to melt the surface of the wax. Melting causes undue expansion and wax granulation. As plasticity slowly develops, the wax is molded between the thumb and fingers into a point sufficiently fine to pass freely between the teeth and reach the gingival wall, the most inaccessible portion of the cavity.

During the warming of the end of the wax, some heat will have been conducted back into the wax so that the opposite end of the wax is very slightly plastic. The fine softened point of wax is passed between the teeth and the whole mass is forced and pressed gingivally. The firmer end of the wax becomes a plunger and forces the softened wax tightly home. The excess which is forced into the proximal portion of the cavity will tend to squeeze, gingivally, bucally and lingually. The excess on the occlusal portion of the cavity will spread over the occlusal surface of the tooth. (Fig. 5.) This methods fills the cavity with wax of minimum temperature and therefore minimum expansion. The thumb and finger of the left hand can be used as a matrix on the buccal and lingual sides and thus hold the wax in the embrasures, and, at the same time, the thumb or finger of the right hand or a good sized ball burnisher can be used to force the wax into the occlusal opening of the cavity. This procedure has a tendency to condense the wax into the cavity.

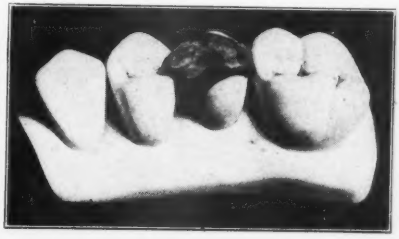

Fig. 5.—Appearance of wax pattern after repeated closure of jaws and adaption.

Such manipulation is continued until the wax ceases to move or flow under pressure. Then it should be bathed with several syringes of warm water, from 100 to 115 F. The patient is then asked to close—not to grind—the teeth. The closure of the teeth has a tendency to accomplish two results: (1) to force the wax still more tightly

into the cavity, if possible, and (2) to indicate the location of the prominent opposing cusps. The wax pattern is again bathed with warm water and molded down with the thumb and fingers. The biting, bathing and readapting should be repeated until the closure of the opposing teeth ceases to disturb the wax.

The establishment of the occlusal plane of the pattern is the next step. (Fig. 5.) This is easily accomplished by the use of the S. U. I., No. 2, manipulated as a burnisher. The edge of the working point should be made to follow the direction of the intended grooves and fissures, thus allowing the side of the working point to shape the inclines of the cusps and ridges. This burnishing or rubbing perfectly adapts the wax to the margins and also cuts it off flush with those margins. With the Ward carver, the embrasures are roughly trimmed out and, if possible, some of the excess wax in the interproximal space is removed. (Fig. 6.) No attempt is ever made to cut the wax flush with a margin. It has been my experience, in attempting to cut wax flush with a margin by carrying the blade of even the finest edged instrument in a direction parallel with a margin, that the elasticity of the wax permits it to feed out on the blade as the blade moves forward, so that when the blade has passed, the wax contracts back into the cavity and thus proves to be scant on the margin of the cavity. Under such conditions, when the inlay is cast and tried into the cavity, it is found that a fine enameled margin stands up about the inlay. So an attempt is made, when carving with a blade instrument, to leave a small excess of wax over the margin, and this excess is finally worked away by rubbing, burnishing and polishing. The explorer, tine No. 23, is next used in an effort to remove the excess of wax around the contact point and in the interproximal space. (Fig. 7.) In many cases, practically the entire proximal surface of the wax pattern can be properly shaped with this instrument. During the process, the wax along the buccal and lingual margins can be burnished and trimmed to flush contour. The direction of cutting, burnishing and polishing should be done toward the walls and margins

Fig. 6.—Wax pattern trimmed and shaped on occlusal surface; wax roughly trimmed out of embrasures.

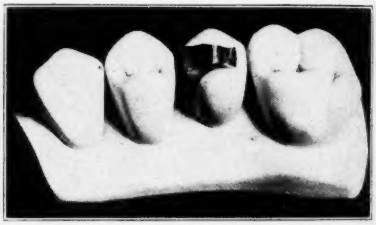

Fig. 7.—Wax closely trimmed buccal and lingual margins and in interproximal spaces.

in order that the wax may not be dragged away from adaptation.

Up to this stage, the contact of the wax with the adjacent tooth is not disturbed. During the shaping of a wax pattern, every effort should be made and all technic planned to prevent the pattern from being bodily moved in the cavity until it is finished and ready to be removed finally. The presence of the wax contact points assists in holding the pattern immovable. If an operator feels that there is danger of disturbing the seating of a pattern at any particular stage of its manufacture, he can have his assistant hold it with a tightly rolled pellet of cotton or a suitable large surfaced burnisher.

Now a piece of "A" silk thread is tensed and carried through the contact. The thread is held tightly against the adjacent tooth on its first passage. Still held tensely, it can be again drawn past the contact and used to shave away any excess of wax that could not be removed with instruments. A tracing cloth strip is next carried into the interproximal space, and the final polishing is done.

All during this operating, the chips are washed away by the use of the water taken from the glass in which the water was originally from 110 to 115 F. This frequent bathing with the warm water has a tendency to relieve the area of both deep and superficial strain that may have developed in the wax during its manipulation. The water has gradually lost its heat until, by the end of the process, it has probably reached room temperature. The metal syringe is intentionally used, as it has a tendency to radiate the heat. The room temperature water has had a tendency to reduce the mouth temperature so that, on the removal of the pattern into room temperature, the change in degrees of temperature is very slight. Therefore, since the elasticity has been practically dissipated, and the expansion and contraction have been compensated, there is little likelihood that any rapid change due to the difference between mouth and room temperature will take place in the pattern. It is advisable to invest the new wax pattern quickly in a room temperature investment mixture. It is not a safe procedure to allow a pattern to remain for any great length of time, even in a fairly constant temperature, before it is invested because, eventually, any areas of tension which may remain in the wax will assert themselves and warpage will result. This is especially true if the room temperature undergoes variation.

The making of wax patterns for any other type of cavity calls for essentially the same rules of technic. Time will not permit a discussion of the details of making patterns for each class of cavity. A little thought and ingenuity on the part of the operator will readily enable him to apply these rules to any class of patterns.

It has been advocated that wax patterns be blown from the cavity by a blast of air or washed out with a stream of water from a syringe. Where it is possible to remove in either of these ways, the cavity has not sufficient resistance for or the wax is not perfectly adapted, or both faults prevail. A perfectly adapted wax pattern in a properly resistant cavity has developed too much

frictional resistance to be dislodged by a stream of water or of air. So only two methods for the removal of a pattern are available: (1) by the use of an explorer and (2) by the use of the sprue. I remove with an explorer tine practically all wax patterns except those for mesio-incisodistal and mesioclusodistal cavities and these I remove on the sprue attached to the center of the occlusal surface or the incisal edge of the pattern.

The same technic of attaching the sprue may be followed whether the wax pattern is held in the hand or remains in the cavity. The sprue should be held by the thumb and finger and the end warmed in the flame sufficiently to melt its way into the pattern quickly. As soon as it has passed into the pattern a sufficient depth to give a firm attachment, the assistant should touch the sprue near the fingers with a pellet of cotton saturated in cold or ice water. This chills the sprue, which, in turn, congeals the wax around its point, and does not subject the pattern to any general temperature change.

In making a wax pattern for some cases, it may be necessary to use a matrix. The most common type of case in which it is required is one in which the adjacent crown is missing. Ordinarily, the matrix is necessary only during the initial adaptation of the wax and can be removed for the final carving and polishing. The requirements of the case will determine whether a matrix must be made or some commercial type of matrix can be used. As a general proposition, I feel that the use of the matrix in ordinary proximoclusal restoration, when the proximating tooth is present, is more of a hindrance to adapting the wax to the gingival than of any practical advantage. The personal equation many times will determine. The semidirect method of making patterns requires the use of a matrix, and best results are obtained in this method by making a matrix to meet the requirements of each case.

The direct method of making a pattern has been discussed in this paper, but the underlying principles can be applied to the indirect method with equally good results.

In the second portion of this paper, the term "gold" will be used to indicate the large group of gold alloys that are used in casting.

Heating and melting cause gold to expand. This expansion is in direct proportion to the amount of heat applied, even to the point of volatilization (if that is possible). During the cooling of molten gold, two stages of contraction are observed. The first occurs during the cooling from maximum fluidity to solidification; the second occurs during the cooling below the solidification point. This second stage has been measured and found to vary with different formulas of gold alloys. The nonexpanding or noncontracting gold alloy has not yet been found. The average percentage of shrinkage or contraction of alloys in this second stage of alloys containing approximately 90 per cent gold is about 1.25. The occlusogingival dimension of an average proximoclusal inlay will measure not more than one-eighth inch, and the dimensional second stage shrinkage of such a casting will amount to about one-six hundred fortieth inch.

In order to compensate for this shrinkage, several methods have been suggested, and have been used with varying degrees of success. One method contemplates expanding the wax pattern and forming a mold while it is expanded. To accomplish this result, two procedures have been used: (1) investing the pattern in an investment of from 100 to 110 F., and (2) expanding the pattern by exposing it for a few minutes to a temperature of from 100 to 110 F., and then investing it in a mixture at the same temperature. The success of this method will depend very largely on a uniform distribution of wax and its physical condition. It must be free of elasticity strains, to say the least. In addition to the expansion of the pattern, it is known that investments expand on setting and on heating and, therefore, under auspicious conditions, can effectually compensate for some of the gold shrinkage. By casting into a hot mold, one follows this same line of reasoning. A special location, size and form of sprue, in order that gold may be drawn from the surplus during the cooling process, is also advocated. The use of a particularly hard or rigid investment material that may reduce or resist the shrinkage has been suggested also. Much experimentation has been carried out along these lines, and, in a few instances, considerable reliable, scientific data have been accumulated; but, up to the present time, no definite practical solution seems to have appeared.

There has been discussion, also, of the relative and absolute strength of investments after they have gone through the various wax elimination processes. Without elaborating further on this phase of the subject, it can be safely asserted that any reasonable method of eliminating wax from a sensibly compounded investment will not distort the mold or deteriorate the investment sufficiently to prohibit the use of a sufficient casting force to insure an accurate filling of the mold.

Since molten gold contracts in two stages, it seems a logical procedure to fill the mold with gold that is just sufficiently fluid to insure the complete filling of the mold, and thus require the minimum amount of gold to be drawn from the surplus in order to compensate for the first stage of contraction. Any gold that may be drawn through the sprue hole to compensate for the second stage of contraction will not be dependent on filling the mold with superheated gold. The reverse conditions must prevail; namely, cooler gold in the mold. Under heat, gold first forms spheroids; then, if heat is continued, the oxid coat or scum breaks and retracts, leaving a bright mirror-like surface on the molten ball. At this stage, the gold is sufficiently fluid to be successfully cast.

There are on the market many meritorious appliances for melting gold and making castings. A blow-pipe that will develop from 2200 F. to 2500 F. will supply sufficient heat to melt the majority of casting alloys. In most localities, the city gas and a suitable blowpipe will be found to be adequate. When using the high percentage platinized gold, it may be necessary to have access to an oxyhydrogen pipe, especially if the heat units of the illuminating gas are low.

I prefer a centrifugal casting machine, simple to operate, positive and quick in action, and permitting the heat-

ing and melting of the gold outside the crucible.

It is possible to centrifuge molten gold to some degree, as Shell has demonstrated. By this action, the most distant portions of the mold are filled with the heaviest or highest carat of gold; which has a tendency to minimize shrinkage. The centrifugal action also leaves the lighter elements of the alloy together with any dirt or impurities in the surplus. This action improves the physical quality of the cast metal. There are many other meritorious machines in use, and acceptable results are obtained in their use when the operator is willing to give some thoughtful attention to the casting process and modify his technic slightly to meet the requirements of the particular machine he is using. To illustrate: The wet asbestos pad that is used in casting has a tendency to chill the molten gold when the pad is applied. This fact necessitates greater heating of the gold to compensate for this chilling effect.

In making castings that require a large amount of gold, it is necessary to bring the gold to a higher temperature in order to permit this greater volume of flow through the sprue channel before the gold freezes. Double or enlarged sprueing may be advisable in some cases. It is logical to assume that there is a definite relationship between the size of the sprue channel, the amount of gold necessary to fill the mold, the pressure and speed with which the gold can be forced into the mold and the degree of fluidity necessary to insure a perfect casting. These factors can be easily evaluated and dealt with by a little thoughtful experimentation.

TREATMENT OF FRACTURES OF THE MANDIBLE*

By ADOLPH BERGER, D.D.S., New York City

THE principles which subserve the treatment of fractures in general are equally well applied in the treatment of fractures of the mandible, with such modifications as may be necessary to meet the peculiarities and the restoration of the function of this bone.

The complete procedure may be divided into four phases: (1) diagnosis and preliminary preparation; (2) reduction of the fracture; (3) fixation of the parts, and (4) the care incidental to progressive treatment.

The more important part of diagnosis should be based upon close clinical examination. In this, attention should be given to the following points: (1) external injuries; (2) the location and the number of fractures; (3) the degree and the nature of the deformity; (4) the amount and the mode of application of the force required to reduce the fracture; (5) the condition of the mouth in general; (6) the number and the condition of the teeth and their distribution; (7) the type of fracture, and (8) the presence of factors which may complicate treatment immediately or during progressive treatment; such as, teeth or their fragments, missiles or other foreign bodies within the line of fracture; the presence of fragments of bone, impacted or supernumerary teeth; pathologic conditions such as cysts, necrosis and neoplasms.

During this examination, it is advisable to determine also the details of the indicated preliminary preparation and the best method of reduction and fixation of the given case.

Most of the foregoing considerations can be ascertained with close clinical inspection. A good radiogram is an invaluable aid, however, in shedding light on obscure points which cannot be appreciated with tactual or visual examination. Radiograms should be made a routine part of the examination of fractures. They are useful because of the information they may render and also as a matter of record.

The examination is followed by preliminary preparation of the oral cavity. This consists of placing the mouth in as clean a condition as circumstances permit. Septic accumulations of tarter, sordes, diseased roots and other septic foci should be removed. External wounds should be cared for according to their indications.

The problem of teeth within the line of fracture may be discussed with benefit at this point. The statement is made frequently that teeth within the line of fracture should be removed.

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

Broader experience in the treatment of fractures of the mandible indicates that this is not always an advantageous procedure. There are numerous instances in which the removal of a tooth within the line of fracture is contraindicated in the early stages of treatment. The removal of a firmly attached tooth (they are not always loose although partly within the line of fracture) often entails considerable trauma, which may be detrimental to the osteogenetic tissues. It is especially contraindicated when such a tooth is the means for maintaining the containing portion of bone in its correct anatomic relationship.

Many of these teeth are best removed prior to reduction and fixation of the fracture. When such a tooth impedes or prevents the coaptation of the broken fragments, when it is not needed for fixation, and is more likely to become infected and cause an abscess, it should be removed, while in some cases, even though the tooth is abscessed, when it is essential for fixation and to attain the best functional result, it should be temporarily retained.

Not infrequently, a tooth may only partly occupy the line of fracture cleavage, and may remain vital, when it may be permanently retained. The prognosis is especially favorable when the apical third of the root is embedded in untraumatized bone.

Such teeth are especially valuable in the treatment of fracture through the angle of the mandible and through the third and second molar regions. In these cases, the posterior fragment tends to become tilted and is displaced upward, forward, inward or outward. A third or second molar, when contained alone in the posterior fragment, is an invaluable support for maintaining this fragment in a favorable relationship, until partial or complete union has taken place. For these reasons, we must not be dogmatic or categorical in the consideration of these teeth, and every case should be treated upon its merits.

The next step to be considered is the reduction of the fracture. This implies the restoration of the disrupted parts to their former relationship. In this, more regard should be given to function than to anatomic detail, although we must recognize that a normal bone alinement, though secondary, is also desirable. As the most important function of the mandible, namely mastication, is performed through the teeth lodged therein, to restore the former occlusion of the teeth is of paramount importance.

In reducing a fracture, we must be guided, therefore, by the occlusion of the teeth. This is so important that, when it is overlooked, and there is a deformity present, the end result is never satisfactory even if there is a complete osseous union.

Such a failure is manifested by impaired mastication, which has much to do with digestion and, therefore, nutrition. The impairment is not confined to this function alone. Other ill results are a deformed jaw with alteration of the appearance; and most other functions will be influenced to some degree.

Exception to this is the treatment of young children who still have some or most of their temporary teeth. In these, although restoration of the normal articulation of the teeth is desirable,

failure absolutely to restore this is not always followed by permanent deformity, as is the case in adults. Minor deviations from the normal are almost always corrected in the course of time during this youthful and plastic age by functional adaptation during the later eruption of the permanent teeth, and by their natural tendency toward functional coordination.

A fracture may be reduced in numerous instances with little or no pain. There are cases in which the parts are bruised and sore or the inferior dental nerve may be infringed on so that every touch or movement causes considerable pain. It is good practice to induce anesthesia by the conduction method with intra-oral or extra-oral injection. This is more satisfactory than a general anesthetic is, as the parts can be freely manipulated. The patient's cooperation may be secured and the complications which often follow on recovery from a general anesthetic, such as vomiting, and the involuntary disturbance of the immobilized parts, are eliminated.

FIXATION

The methods of fixation may be classified into two general groups: 1. Mechanical fixation. This may be: (*a*) intraoral; (*b*) extraoral, or (*c*) a combination of the two. 2. Surgical fixation. This may be: (*a*) direct; (*b*) indirect.

The methods or means of fixation must conform to the following requirements. They must be simple in construction, easy in application, effective, expedient, practical and convenient from the standpoint of the operator and also of the patient.

The intra-oral fixation conforms in most respects to these requirements, and, when it is judiciously employed, will secure the largest percentage of satisfactory results, as to both function and anatomic relationship. In immobilization, the mandible alone or both jaws may be involved, and the appliances used may be grouped into two classes: (1) those which depend on the mandible or mandibular teeth alone for anchorage, and (2) those in which the teeth of both jaws are utilized for the purpose.

In the first group belong the single arch or cap splint and the different methods of wiring, wire splints and orthodontic arches described in text books. These are applicable to advantage in the types of cases in which the fractured parts retain their normal anatomic relationship through the juxtaposition of the severed surfaces or the displacement can be easily corrected with finger manipulation.

Of the appliances which may be attached to the mandibular teeth alone, the single arch or cap splint is the most effective when indicated. The prerequisite for this appliance is the presence of a sufficient number of firm teeth to which it may be secured. Besides being effective and convenient, it has the added advantage that it permits unincumbered function during treatment.

When there is loss of bone or considerable displacement of the parts which necessitates gradual reduction, it may be applied to advantage after sufficient repair has occurred, although ossification is incomplete. This is indicated especially when prolonged intermaxillary fixation enforces a limited diet, which may become detrimental to the patient's general health.

Of the intraoral methods of fixation in which both jaws are involved, the intermaxillary wiring is the most effec-

tive where there are a sufficient number of teeth available. This method has several advantages. Its application is almost universal; it is simple and easy to apply; it is effective and expedient. It is not cumbersome, no preparation of mechanical devices is required, and when judiciously used, it has the least injurious influence on the teeth and their investing tissues.

It has the further advantage that a fracture can be reduced and immobilized in a few minutes and the parts can be observed during treatment. Any later deformity or shifting of the parts caused by muscular action or by sagging of the wires can be detected and corrected before union of the bone has taken place. It also permits gradual reduction of the parts when this cannot be achieved at once.

There are different methods for the application of the wires, but I have found that the simplest and probably the oldest method is the most effective and least injurious to the teeth and investing tissues. This consists of simply passing and securing wire loops about the neck portion of individual teeth in both jaws, except in the case of lower anterior teeth when two teeth are enclosed in a single loop. These wires are twisted together, bringing the teeth into occlusion, and the mandible is firmly attached to the maxilla. The so-called Angle ligature wire has been found to be the most desirable for the purpose. It is pliable, is sufficiently strong and is not acted on by the secretions of the oral cavity.

Other forms of wiring have been introduced from time to time, but they offer no advantages over this method and often have some disadvantages. The application of wires as described by Ivy is the most notable of the more recent methods introduced. In this wire, loops are made on each jaw, and the parts are immobilized with secondary wires passed through the loops. Where little or no force is required to reduce the fracture, this method has the advantage that, if it should be necessary to open the mouth during treatment, the principal wires do not have to be disturbed. This has been tried on numerous cases at the Vanderbilt Clinic and in my practice I have found that it takes much longer to apply the wires, and as the secondary wires are depended on for the approximation of the jaws, they usually fail where force or gradual reduction is necessary. I have also noted that the strain on the teeth is more wearing and also that, in most cases, the anterior teeth least fitted to bear the strain have to be utilized.

The extra-oral means of fixation comprise the various bandages and the chin caps with head straps. Of these, the Barton's, the Gibson's and the four-tail bandage are best suited to the treatment of fracture of the mandible. Bandages, in general, are not the most effective means of fixation. They may be satisfactory in the simplest type of cases, in which there is none, and no tendency toward displacement of the parts. In these, they may be helpful in overcoming or counteracting muscular strain, but, in the more complicated conditions, they should be regarded merely as temporary or supplementary means of fixation.

With some men who lack experience in this field, the plaster bandage is one of the favorite means of immobilizing a fractured mandible. It is placed with utter disregard for all principles underlying the treatment of this bone. It is

needless to say that the results are always deplorable.

EXTRA-ORAL AND INTRA-ORAL FIXATION

Extra-oral and intra-oral fixation are best exemplified by the Kingsley splint. This was originally constructed for the treatment of fractures of the maxilla and for edentulous jaws. The device is so made that the appliance proper holds the disrupted parts in their normal or best obtainable relationship, and straps or bandages passed over the skull or underneath the chin are depended on for fixation.

Many modifications of these different appliances have been introduced through the years, designed to meet the needs of individual cases, by Martin, Beltramy, Schroeder and others. Ingenious devices have been constructed during the late war for the treatment of fractures, which were more mutilating, and therefore more complicated, than those we meet ordinarily in civil practice. Notable contributions have been made in this direction by Hayes, Kazanjian, Eby and others.

The construction of devices of the unusual type greatly depends on the experience, skill and ingenuity of the operator. To be effective, they must conform to one central guiding principle, which may be epitomized in the phrase, "the restoration of the function of the mandible attained through coordination of the masticating apparatus."

All other considerations must be made subservient to this. When the articulation of the teeth, or the anatomic relationship of an edentulous jaw, is restored so that effective prosthetic restoration may be sustained by the parts, all other functions will coordinate themselves even in the presence of newly formed relationships or deformities. When such restoration is not achieved or made impossible, most of the important functions become unbalanced; the appearance of the individual is altered—as a rule not for the better—esthetic prosthetic restorations become difficult, and even psychic perversions may arise.

DIRECT SURGICAL FIXATION

The direct surgical fixation consists of drilling holes through the fragments and securing them with silver or bronze wire. A second method consists in exposing the bone and attaching metallic plates to the bone surfaces by means of metal screws.

Both of these methods have not only failed invariably in securing bony union but they also cause necrosis and loss of considerable bone. Furthermore, the apparent anatomic coaptation of the broken bone surfaces does not imply that the articulation of the teeth on which function depends has been restored. The converse of this is that, when the articulation of the teeth is restored, proper function and satisfactory union is more certain to follow, even if there is some degree of discrepancy in the coaptation of the broken surfaces. I believe that the foregoing expression reflects experience in general with this method, and no further comment is necessary to discredit it.

INDIRECT SURGICAL METHODS

The indirect surgical fixation depends on the use of autoplastic bone graft. The transplants taken from the crest of the tibia or the ilium have been found to be the most favorable in this work.

The pedicled graft has been favorably spoken of by some men. This operation is not to be regarded as a modality of fixation. It is invaluable where, because of loss of bone, the continuity of the bony framework is broken and the correction of the resulting deformity becomes necessary. The technic of this operation is exacting and precise. Besides the failings inherent in bone grafting in general, there is constant danger lurking in the direct contamination of the wound and the graft by breaking through the oral mucosa or from latent infections, which are frequently harbored in the jaws and are often fatal to the transplant.

In the treatment of necrosis, especially in children or when there is considerable comminution of the body of the mandible or in surgical fractures following the removal of new growths, in order to obtain the best results it is important to make provision whereby the parts to be retained can be maintained in their normal relative position. When the case is satisfactorily handled from this standpoint before deformity and cicatricial fixation occur, bone transplantation, in the cases which permit of such a procedure, will be facilitated or may be entirely obviated by the use of prosthetic appliances. The degree of deformity in these cases is often proportionate to the adequacy and promptness of comprehensive dental and oral treatment and prosthesis.

COMMUTED FRACTURES

In the presence of extensive comminution, it is always best to restore the fragments with hand or finger manipulation into the most favorable position for cicatrization. Surgical wiring of the fragments or their immediate removal is contra-indicated. In the first instance, their viability already undermined is rendered even more precarious; in the second instance, it is impossible to state at an early stage which fragments will necrose.

In either event, they may serve as a temporary scaffolding for progressive bone repair. Too much interference at this time may be injurious to the osteogenic tissue, and there is a further possibility of destroying the blood supply, which is of vital importance in regenerative and repair processes.

DaCosta states that, in almost all cases of fracture, a portion of the periosteum is broken, but some portion of it remains intact, forming what he terms the periosteal bridge. Rohde,[1] in his recent investigation of bone repair, states: "The amount of bone regeneration attained depends directly on the extent to which the blood vessel connective tissue apparatus of the organ or tissue is disturbed through the damaging influence of the processes following the injury or infection." Therefore, it is important to remember how essential it is to preserve the blood supply and to avoid changes in the blood vessel apparatus of the bone in question which might result from manipulation to obtain a complete anatomic and functional result.

The principles outlined for the treatment of fractures of the body of the mandible should be observed in the treatment of fractures of the ascending ramus and that of the condyle. These fractures are, as a rule, simple, as this part of the bone is thoroughly surrounded by muscles, tendons and liga-

1. Rohde, C.: Surg. Gynec. Obst., 41: 740 (Dec.) 1925.

ments. The results obtained in a series of five fractures through the condyle, within the past two years alone, assure me that this is the proper procedure. I question the soundness of the practice of compounding a simple fracture when this can be avoided, and the attempt at reducing the fracture by transosseous wiring or by simply pulling it over into the desired position. When the first is done, necrosis with its complications is certain to follow; with the second measure, the fragment will soon be displaced by muscular action as this portion of the bone is acted on even though the body is immobilized. Besides, dividing the overlying soft tissues may lead to permanent impairment of function of some of the structures.

If the condyloid fragment is restored as closely to its original position as possible by finger manipulation, and the occlusion of the teeth and surgical rest are maintained, good function of the mandible and no impairment are more certain results, although the alinement may not be absolute.

In exceptional cases, such as is described by Lyons,[2] the condyloid fragment may be so displaced that it acts as an impediment in the articulation of the joint. In such extreme cases, it is better practice to remove this detached portion of bone than to attempt to retain it.

Some men are under the impression that if complete alinement of these parts is not assured, ankylosis is likely to follow. We must recall here that the temporomandibular joint is a complete anatomic unit. The constituent structures, the condyle, the interarticular fibrocartilage and the glenoid fossa are completely enclosed by the capsular ligament. Experience has proved that such anticipation is ill-founded. If the structures which comprise the joint proper are not torn or badly injured, the fracture external to these will repair without impairing the joint; whereas, the attempt at reducing these parts through an extraoral or intraoral incision will cause trouble. In the presence of progressive bone repair, an open wound may become inundated by the inflammatory exudates, and through this channel, the elements of bone regeneration, which may lead to ossification and ankylosis. The formation of unyielding cicatrices and false ankylosis, and the probable severing of some of the fibers of the facial nerve or the internal maxillary artery are also to be considered.

The problem of mobilizing the fractured parts before complete ossification has taken place is deserving of discussion. It has been observed that, in some cases of delayed union or psuedoarthrosis, a more complete ossification has followed, with the mobilization of the parts. It is important that good judgment be used as to when this should be done.

In the presence of a deformity which it requires considerable force to reduce, unless fixation is effective, there is a constant tendency toward displacement of the parts. I have seen numerous cases in which the too early removal of fixation was followed by deformity, with osseous union, and the correction of the deformity could be accomplished only by refracturing the jaw.

2. Lyons, C. J.: Fractures and Dislocations of the Jaws, p. 28.

Rohde[3] may here again be quoted with benefit: "Unlimited mechanical stimulation from the beginning damages quite markedly the sensitive marrow and endosteum and as a result much less callus is formed than in animals in which the damaging mechanical stimulus is reduced as much as possible. Furthermore, the free use of the extremities in the first weeks has a delaying influence upon the bone formation in the early callus tissue."

My observation has been that, whenever a neglected or untreated fracture has come under my care, after five or six weeks there was scarcely any or very little solidification of the fractured parts, although repair usually takes place in from four to six weeks.

Correction of fixation is advantageous in those cases in which complete ossification is delayed but the parts are fixed in their intended position by fibrous tissue. From the results, we may assume that a limited degree of motion is capable of stimulating the specific bone forming cells.

3. Footnote 1, p. 754.

10 East Seventy-fourth Street.

FRACTURES OF THE MANDIBLE*

By DOUGLAS B. PARKER, M.D., D.D.S., New York City

IN reviewing the fractures about the face, we invariably find that the largest percentage of these are fractures of the mandible and of the nasal bones. This is readily seen, because of the prominence of these bones in the contour of the face, which makes them most susceptible to trauma of all kinds, because the mandible occupies such an important place in our physiognomy and general appearance, and has such an important function to perform in our physiology that it is well that its injuries be thoroughly discussed. To those of us who have been fortunate enough to have clinical experience in the larger centers of the world, fractures of the mandible are quite common. I venture to say that with the ever-increasing hazards of modern civilization, characterized by the automobile, aeroplane, and other rapid means of transportation, there probably will not be any marked diminution in the occurrence of fractures, despite the increasing efforts to promote safety and peace.

May we hope that, by increased knowledge, and by discussion of the problem of fractures of the mandible, these cases will be better handled in the future. If there are a sufficient number of capable men to handle the fracture problem, perhaps fewer inexperienced physicians and surgeons will attempt to treat these cases, with such poor results as they have sometimes obtained in the past.

The classification of fractures of the mandible, while basically similar to

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

fractures of other parts of the bony skeleton, must of necessity differ in detail, because of the complications of the teeth, oral cavity and the diversified muscular attachments. We can classify mandibular fractures in one of several ways: (1) in the usual classic manner, as to whether they are, simple, compound, comminuted, linear, greenstick, spiral, impacted or complicated fractures, involving important adjacent structures; (2) as to its origin; (3) as to the position of the line of fracture; (4) as to the displacement of the fractured ends of the bone. If we classify mandibular fractures as to their origin, they may be classed as follows: fractures caused by (1) penetrating missiles (such as bullets); (2) rapid impact (such as precipitation from automobiles, aeroplanes or other rapidly moving vehicles); (3) impact by soft bodies, (such as fists, etc.); (4) surgical manipulation (such as extraction of teeth), and (5) pathologic conditions, such as infection of the bone or absorption of the bone accompanying cysts or neoplasms.

We may classify them as to the point of fracture as follows: fracture of (1) the symphysis; (2) the body; (3) the angle; (4) the ramus, and (5) the condyle. The incidence of each class depends on the type of trauma, its point of application and the natural weak points of the mandible, which are in the regions of the lower cuspid and third molar teeth.

The diagnosis of fractures of the mandible can be established, first, from the subjective history of trauma, as obtained from the patient (the usual sequelae of such trauma are pain on active motion, inability of the patient to move the mandible in the usual manner and the failure of the patient to bring the teeth into occlusion, or use any masticatory force); secondly, from the objective history, as obtained on the examination of the parts, which may show marked external deformity or abnormal occlusion of the teeth, as seen from studying the wear on the cusps from former normal contact. The mandible may show crepitation on manual manipulation, but the lack of such crepitation or mobility is not conclusive of the absence of fractures. The radiogram is probably the most accurate means of determining fracture of the mandible. Such radiograms should be taken on large films or plates, and should be taken, if possible, at more than one angle, showing the entire side of the jaw. It is expedient to take pictures of both the right and left sides, because, many times, there is more than one fracture sustained by the injury, which might have been overlooked in the ordinary examination, and the knowledge of which might alter one's decision as to the method of treatment. In reading the radiogram, it is extremely important to note the diseased area about the teeth, as well as the teeth in the proximity of the line of fracture. In making an accurate diagnosis, it is important to note swellings either in the mouth or externally, indicative of infection, and to note injuries to the nerves, as shown by anesthesia distally from the point of fracture.

Medical literature is rich in its reference to the treatment of fractures of the mandible. Historically, we can refer back to the writings of Hippoc-

rates, Celsus, Galenus, and others, who go back to periods some of which antedate the Christian era. In the treatment of mandibular fractures, we cannot too strongly emphasize the importance of getting these cases into competent hands as early as possible. Frequently, we see these cases after days and weeks have elapsed. This delay, many times, complicates the subsequent treatment. Many of these cases have been admitted to hospitals because of other injuries, which seem so much more obvious that the fracture of the mandible is either not recognized early or the treatment of lacerations or contusions have been instituted first, with the thought that the fracture should be taken care of as a secondary consideration. The fact that so many physicians lack the technic and skill in the proper application of appliances to bring the teeth into correct occlusion is responsible for their resort to gauze or plaster of Paris bandages as their usual method of fixation. This is at best only a temporary expedient, and gives results only in those cases in which there is no displacement of the bony parts.

The treatment of fractures of the mandible should, of course, follow an accurate diagnosis and study of all the radiographic evidence, before determining the type of splint or appliance to be used for fixation in the individual case. I disagree with many who feel that, in compound fracture of the mandible, when there are external lacerations and contusions, the injuries to the soft parts should be treated first. I feel that both should be handled at the same time; that is, reduction of the fracture and temporary fixation should be instituted, along with the suturing, dressing or drainage of the soft parts. In this way, infection is reduced to a minimum, and the subsequent permanent fixation is much easier of accomplishment, no matter what type of appliance is to be used. Fixation, within the first twenty-four or forty-eight hours after injury, is one of the most valuable points in our successful treatment.

What to do with teeth in the line of fracture is a question which has been the subject of much discussion in the past, and many experienced clinicians are apt to draw hard rules as to the management of such conditions. Many of us feel that each individual case should be judged solely on its merits. As a general rule, teeth in the line of fracture, if pulpless, abscessed or fractured, or a tooth involved in a comminuted fracture should be removed before fixation of the fracture. There are extenuating circumstances when an anterior oblique fracture occurs between the second and third molars, with marked displacement of the posterior fragment. Here, the retention of the third molar in the line of fracture is a great aid in the fixation of the posterior fragment. If such a tooth is markedly infected, as frequently occurs, our only recourse is to adequate drainage or extraction of the tooth. When a third is in the line of fracture, and the chief line of cleavage is distal to the third molar, especially when such a tooth is only partially erupted, it is better to extract the tooth, because a large percentage of such teeth are the seat of pericoronal infections in the presence of irritation. Such teeth frequently infect the adjacent soft tissues and cause a

contraction or trismus of the masseter and temporal muscles, often necessitating incision for drainage, when left in place. The fact that the break is posterior to the tooth makes it of no value in retaining the posterior fragment in position.

The retention of the bony fragments, in perfect alinement, and the restoration of function are our aim, in the treatment of fractures. For that purpose, we have many types of mechanisms to choose from. Our choice depends on the position of the fracture in regard to muscles which tend to displace the fragments; on the presence or absence of teeth; on the condition of the adjacent teeth at the point of cleavage, and on the presence or absence of infection.

When teeth are present, we have to determine whether the break is (1) anterior or (2) posterior to the last remaining tooth, on the side of fracture. If the break is in the first class, we can utilize the teeth on either side of the fracture, as anchorage for our splint. When the break is simple, and is in the anterior part of the mouth, I prefer to use interdental fixation, rather than mandibulomaxillary support. When the fracture is anterior, with sound adjacent teeth, and good occlusion, the simplest fixation is a figure of eight wiring about the cervical margin of the teeth, utilizing two or three teeth on either side of the line of fracture. An arch wire as applied by Dr. Gilmer, or, more elaborately, by Dr. Angle, lends adequate support. The advantage of the foregoing methods is their simplicity and ease of immediate application, without waiting for metallic or vulcanite cap splints to be made up in the laboratory. Swaged or cast metal splints have more support in the more complicated cases, but are more difficult of proper application and of removal. The general tendency, at the present time, in the treatment of fractures of the long bones, as well as in the mandible, is to allow function to take place as early as possible. In interdental types of splinting, the mandible can have a certain amount of function, and the patient does not have the discomfort of having a tightly closed mouth, which cannot easily be inspected or thoroughly cleansed.

In fractures of the second class which are posterior to the last remaining tooth, on the fractured side or where the displacement of bone cannot be readily accomplished, it is advisable to use mandibulomaxillary fixation, if a sufficient number of teeth are present to afford attachment. At times, we have to combine our splint with some type of extension which will exert pressure on the posterior fragment, to keep it from overriding, or being pulled upward, and inward, by the action of the pterygoid and temporal, and masseter muscles. The simplest type of mandibulomaxillary fixation is by the "army" method of wiring, as described so adequately by Dr. Ivy of Philadelphia, in several recent papers.[1] I have modified this method slightly by carrying one of the encircling wires about the teeth and through the loop; which has the advantage of preventing the loop from being drawn in between the interproximal spaces, when the wires are twisted tightly enough to prevent slipping. I understand that Dr. Ivy is also doing this at the present time. The above described method is easy of ap-

1. Ivy, R. H.: Surg. Gyn. Obst., 34: 670 (May) 1922.

plication and allows of frequent and easy inspection and cleansing of the mouth by the operator. The double arch wire, wired to the teeth of the upper and lower jaw, as described many years ago by Dr. Gilmer, of Chicago,[2] is very satisfactory, and allows of various adjustments along the line of occlusion. The cast mandibulomaxillary splint, or the double mandibular and maxillary splints, fastened together, by either pins or screws, are good in selected cases, where subsequent adjustments of the parts are not necessary. A simple method of making mandibulomaxillary and mandibular cap splints of celluloid has recently been described by Drs. Dorrance and McWilliams,[3] of Philadelphia, who assert that a splint can be made in a few hours, after an impression has been taken. The direct wiring of bone is seldom used, and then only in complicated cases. The history of such cases has not been generally favorable.

When wires are used for interdental or mandibulomaxillary fixation, No. 22 gage annealed copper wire is extremely useful, as it is sufficiently flexible yet does not break so easily as much of the orthodontia ligature wire in common use for this purpose. In place of the connecting wires between the loops, in the "army method" of wiring, Japanese grass line can be used. This has the advantage of being easily tied in place. It has sufficient shrinkage to keep the parts tightly together, and can be cut with any ordinary pair of scissors. I have had considerable difficulty, at times, in removing cast metal splints which have been cemented in place. It is very helpful in these cases to cut grooves or lines of cleavage before cementing them in place, so that it will facilitate the removal of such splints as do not readily separate because of adhesion to the teeth when union of the bones has taken place.

We have still another class of case to consider, those which need external support by the use of the Barton bandage or chin cap, and head attachments. I refer to those cases in which the mouth is edentulous, or the fracture of the mandible is complicated by a complete fracture of the superior maxillae. In such cases, the top of the head should be used as the fixed point of support, and we have to employ ingenuity in devising comfortable appliances to retain the fracture in good position.

While we have been considering, in general, the reduction and retention of fractures, we must not overlook the after-care of such cases. Frequent cleansing of the mouth with mild alkaline mouth washes is quite essential, as well as frequent inspection of the mouth for infection about the line of fracture. Diet plays an important part in our treatment. At least five feedings of nourishing food a day in soft or fluid form are advisable, as well as seeing that the diet contains a sufficient quantity of foods rich in calcium salts to facilitate bone repair.

In conclusion, I wish to reiterate that early fixation in normal occlusion and the control of infection are the two main considerations, so essential to success, in the treatment of fractures of the mandible.

121 East 60th Street.

2. Gilmer, T. L.: Arch. Dent., September, 1887.

3. Dorrance, G. M., and McWilliams, Hugh: Dent. Cosmos, 67: 865 (Sept.) 1925.

FRACTURES OF THE MANDIBLE*

By ROBERT H. IVY, M.D., D.D.S., F.A.C.S., Philadelphia, Pennsylvania

ETIOLOGY

IN 100 consecutive cases of fracture of the mandible recently studied,[1] the bare fist was responsible for 49 per cent; 14 per cent were occasioned by falls; 8 per cent were complications of automobile accidents; 5 per cent occurred during extraction of teeth, and 3 per cent were acquired during football games. The etiology in the twenty-one other cases was miscellaneous, such as being hit by a batted ball, being shot with a 45 caliber pistol and being jammed between two freight cars.

LOCATION

The accompanying table gives the location of the fracture in this series.

It will be observed that, in the majority of bilateral cases, the fracture on one side is in the mental foramen region and at or near the angle on the other. In every case of fracture near the mental foramen, we should always look for a second fracture at the angle of the opposite side. It will be found in about 55 per cent of the cases. It is surprising how often this is overlooked and how many times a roentgenogram is made of but one side, where the fracture is apparent.

LOCATION OF FRACTURES

Single	68 per cent	
Double	31 per cent	
Triple*	1 per cent	
Of sixty-eight single fractures:		
Angle	30, or 44.1 per cent	
Mental foramen region	21, or 30.8 per cent	
Symphysis region	6, or 8.8 per cent	
Molar region	6, or 8.8 per cent	
Neck of condyle	5, or 7.3 per cent	
Of thirty-one double fractures:		
Mental foramen one side and angle opposite side		24, or 77.4 per cent
Mental foramen region and angle same side		2, or 6.4 per cent
Angle and symphysis		2, or 6.4 per cent
Condyle and mental foramen same side		1, or 3.2 per cent
Condyle and angle opposite side		1, or 3.2 per cent
Both mental foramina		1, or 3.2 per cent

*This involved the symphysis region and the necks of both condyles.

DIAGNOSIS

Fracture should be suspected in every case of trauma to the region of the

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

1. Ivy, R. H., and Curtis, L.: Dent. Cosmos, 68: 439, 1926.

lower jaw until careful examination proves otherwise. Many cases are discharged from the accident ward of the hospital as simple lacerations or contusions of the face, only to return several days later with symptoms of an infected unreduced fracture. With a history of trauma, the most important points in diagnosis are as follows: inability of the patient to bring the lower teeth into correct occlusion with the upper; severe pain at the site of fracture when the patient attempts to bite a hard object such as a wooden tongue depressor inserted between the teeth, and preternatural mobility of the teeth on each side of the fracture. In a fracture through the mental foramen region, the chin fragment is drawn down by the depressor muscles, while the posterior fragment is drawn up by the levators (temporal, masseter, internal pterygoid). In fracture through the ascending ramus or neck of the condyle, there is shortening from angle to condyle; hence, the chin and lower incisor teeth deviate to the affected side. In closing the jaw, the upper and lower molar teeth on the affected side will meet sooner than those of the opposite side. It is rarely necessary to subject the patient to painful manipulation to elicit preternatural mobility or crepitus. Good roentgen-ray plates of both sides of the jaw and to include both condyles should be made in all cases of suspected fracture of the mandible. The region of the symphysis is best studied radiographically by means of a 2¼ by 3 inch film inserted horizontally between the upper and lower teeth and the rays directed from beneath the chin. The roentgen ray is valuable in all cases in determining the direction of the fracture, comminution, injuries to roots of teeth and involvement of teeth in the fracture. It plays only a minor part as a criterion of position of the fragments.

TREATMENT

Practically every fracture occurring in the part of the mandible occupied by teeth is compound into the mouth and is exposed to infection. Every care, therefore, should be taken to reduce the chances of infection to the minimum. This is accomplished by early removal of sources of infection such as tooth roots exposed in the line of fracture, badly diseased teeth wherever situated and tartar deposits. Early immobilization of the fragments will also reduce the tendency for infection from the mouth to work its way down in the fracture line. Throughout the course of treatment, the patient should be encouraged to use a toothbrush and a mouth wash containing hydrogen dioxid. Cooperation of the patient is essential in maintaining cleanliness of the mouth. No amount of cleansing by a second person will compensate for failure on the part of the patient himself to attend to this.

The seat of fracture or fractures having been determined, it is next important to examine the teeth in regard to their occlusion, general condition and suitability as points of fixation. The method of fixation to be employed will depend largely on these points. The removal of certain teeth with roots in the line of fracture may be delayed in exceptional circumstances when they may be important in maintaining reduction. In the mandible, more than in any other region, accurate realinement of the fragments is necessary, because the slightest deviation of the parts (except in edentulous cases) will result

in malocclusion of the teeth and consequent interference with proper mastication. The fundamental principle, therefore, in treating these cases is fixation of the fragments so that the teeth of the lower jaw will be in proper relationship to those of the upper. In selecting the method of fixation to be used, the location of the fracture is not so important as the availability of teeth as points of attachment. Much space is given in surgical textbooks to obsolete methods which are not practical for the surgeon who sees the average case. Reliance on a head bandage alone in the average case has no more value than would a mere bandage in a fracture of both bones of the forearm. Direct wiring or plating of the fragments should not be attempted in recent fractures which communicate with the mouth. In 90 per cent of cases of fracture of the mandible, no matter where situated, adequate fixation can be obtained by fastening the lower to the upper teeth, by means of wire ligatures, according to the method to be described. The other 10 per cent may require the cooperation of the dental laboratory to prepare interdental splints suitable for the individual case. There are many advantages of the wiring method over the use of splints. In the first place, there is less discomfort to the patient than that caused by taking impressions; in fact, the wires can be placed about the teeth without giving any pain by injecting a few drops of 1 per cent procain into the gum tissue which comes in contact with the wires. With the wires, the case can be fixed in the time taken to obtain impressions for splints. Splints cover the teeth, but, with the wires, there is no material between the upper and lower teeth and the teeth are uncovered so that the state of occlusion is under direct observation at all times. If, during the course of treatment, it becomes necessary to open the mouth, as for removal of a tooth, or to treat the fracture, or to replace a broken wire, it is far easier to cut a few wires than to remove a splint which is cemented to the teeth, and with less disturbance to the parts.

TECHNIC OF WIRING

Some years ago, Gilmer[2] pointed out the value of intermaxillary wiring of the teeth in fixation of fractures of the mandible. The method routinely employed is a modification of Gilmer's principle, which permits of opening the jaws during treatment, to replace a broken wire, or for any other purpose, without disturbing the main attachments. This has been described by Eby,[3] Ivy[4] and others. It consists, briefly, in fastening 6 inch strands of 24-gage brass wire, with an eyelet made in the middle of each strand, around the necks of the bicuspids on both sides of the upper and lower jaws, the upper central incisors and the lower four incisors, joining these three pairs of approximating wires with three single wires passed through the eyelets, and twisting the ends together after the teeth have been brought into proper occlusion. If the teeth usually used for wiring are absent, diseased or otherwise unsuitable as attachments, other teeth are used, the aim being to have three pairs of eyelet attachments. Occasionally, when the teeth are not sufficient in number and

2. Gilmer, T. L.: Arch. Dent., September, 1887.

3. Eby, J. D.: Internat. J. Orthodontia, 6: 273 (May) 1920.

4. Ivy, R. H.: Surg. Gynec. Obst., 34: 670 (May) 1922.

stability for direct application of eyelet wires, we employ a plain heavy German silver half-round wire arch attached to the labial aspect of the teeth of each jaw with wire ligatures. This method has been used routinely by Gilmer for several years, but we find that it requires more time for application than the eyelet method, so reserve it for the more complicated cases.

The two principal types of case in which a special interdental splint made from impressions is necessary are as follows: 1. A fracture in the body of the mandible with a long posterior fragment without teeth. This posterior fragment, having no teeth to oppose the molar teeth of the upper jaw, is drawn up by the elevator muscles, and the overlying gum comes in contact with the upper teeth. If the fracture is allowed to unite in this position, it will not be possible to replace the missing teeth with an artificial denture. Even here, it is sometimes possible to interpose a piece of softened dental impression compound to cover the gum over the posterior fragment, filling in the space between it and the upper molars. The teeth in the main mandibular fragment are then wired up in occlusion with the upper teeth, the impression compound keeping the posterior fragment down in place. But, more often, it is better to have prepared a splint with a more permanent attachment extending back to rest on the gum. 2. The case in which the posterior fragment has teeth but may be difficult to maintain in position because of the absence of opposing molars in the upper jaw. Here, the difficulty is best overcome by a splint with extension to the molar region of the upper jaw.

The technic of splint making will not be discussed here. The splints may be made of vulcanite, celluloid or cast metal, according to which is most suitable for the individual case. The upper and lower sections of the splint should be made separately and arranged so that they can be locked together by means of hooks and wires, or bolts passed through tubes.

FIXATION IN EDENTULOUS CASES

It is usually recommended that, for edentulous cases, full upper and lower vulcanite dentures can be inserted, fastened together and held in place with a bandage. It is generally impossible to provide sufficient fixation of the fragments in this way. When there is no break in the mucous membrane, fixation can sometimes be accomplished by wiring or plating the fragments, the site of fracture being exposed under aseptic conditions through a skin incision. In as small a bone as the mandible, especially in an edentulous person, when much absorption has taken place, firm fixation of fragments in this manner is difficult to obtain.

A much better plan for edentulous cases is circumferential wiring of the bone, first employed, according to Gilmer,[5] by G. V. Black. A vulcanite splint is first made like a saddle, to cover the alveolar ridge on each side of the fracture; or, if the patient has a lower vulcanite denture, this may serve the same purpose. Under local anesthesia, a small incision is made through the skin at the lower border of one of the fragments, and a small curved trocar and cannula are passed through this incision close to the bone lingually,

5. Gilmer, Lectures on Oral Surgery, Chicago, 1901.

until the mucous membrane of the mouth is pierced. The trocar is then removed and one end of a 16 or 18 gage silver wire is threaded through the cannula from below. The cannula is withdrawn and, by means of the trocar, is passed downward from the mouth close to the bone, this time on the labial side, to emerge at the original skin opening. The other end of the wire is then passed up through the cannula, and the latter withdrawn. Thus, the silver wire embraces the lower border of the bone with the two ends protruding into the mouth. The ends of the wire are now twisted over the vulcanite splint or denture so that the bone fragment is drawn up snugly in contact with the splint resting on the gum. Another wire is similarly passed around the other fragment and twisted over the splint. The circumferential wires are well tolerated and can be retained for several weeks, the skin incision frequently closing without suppuration. Even when teeth are present, it frequently happens that this circumferential wiring is a useful adjunct to the regular methods of fixation.

The average time required for union in fractures of the mandible is about forty-two days. This statement is based on a study of 100 cases, first seen at varying times after receipt of the injury, in many of which suppuration was present.

FEEDING

When the jaws are wired together, the diet must generally be restricted entirely to fluids. It is never necessary to extract teeth to provide space for the passage of food. There is always sufficient space, either through places where teeth have previously been lost, or behind the last molar teeth, for liquid food to pass. The liquid diet is usually administered through a tube. As much variety as possible is essential in order to provide sufficient nourishment. The patient on liquid diet loses weight at first, but, after a time, with proper selection and variation, he begins to gain.

COMPLICATIONS

Abscess formation due to infection of the line of fracture occurs in about 10 per cent of the cases. Drainage through the skin incision is usually required. In about 9 per cent, sequestra have to be removed.

Nonunion is rare in fractures of the mandible, unless complicated by large losses of substance, as seen in gunshot fractures. About 11 per cent of gunshot fractures result in nonunion, but less than 1 per cent of mandibular fractures seen in civil life result in nonunion. The proper treatment here, after elimination of local and general infections, is bone grafting, preferably from the crest of the ilium.

Malunion is a common sequel of fracture of the mandible when not properly reduced and fixed, and, when pronounced, may require division of the bone through the original line of fracture, reduction of the fragments and fixation as in the case of a recent fracture. The best method of dividing through a firmly united fracture line is by a Gigli wire saw, introduced in the same manner as the circumferential wire, with a trocar and cannula. This operation usually requires a general anesthetic. Where splints are required for fixation, they should be made in sections, cemented to the teeth of each fragment prior to

operation and locked in position with bolts, after reduction.

DISCUSSION OF THE PAPERS OF DRS. BERGER, PARKER AND IVY

Thomas B. Gilmer, Chicago, Ill.: My experience coincides in the main with that of Drs. Ivy, Berger and Parker, regarding the etiology, location and treatment of these fractures. Treatment by the older methods made these fractures more difficult than the treatment of fractures of most other bones, because of the greater number of muscles attached to this bone. For instance, the surgeon has to contend only with the muscles of locomotion attached to the long bones when fractured, while, in a mandibular fracture, he must, in addition, overcome traction of the mylohyoid, geniohyoid and geniohyoglossus muscles, all of which tend to cause displacement of the fragments of this bone. There are two causes for displacement of the fragments in a fractured mandible: (1) the force that caused the break and (2) muscular traction. The latter is especially pronounced in double fractures in the bicuspid region, the anterior fragment being drawn down and back by the muscles attached to the genial tubercles, the hyoid bone and the tongue. Wiring the teeth of the mandible to those of the upper jaw is by far the simplest and most efficient method of treatment of all mandibular fractures, if there remain in the jaws a sufficient number of firmly set teeth. My older method, the direct wiring of the lower teeth to those of the upper, answers an excellent purpose, but I improved on this method some fifteen years ago and since then have abandoned my older method, and, as Drs. Ivy and Parker have said, have employed the expansion bar used by the orthodontist, wiring it to the buccal and labial surfaces of the teeth of both upper and lower jaws, when the teeth of the broken jaw are brought into occlusion with those of the upper and held in occlusion by two or more wires passing from the lower to upper bar. Dr. Ivy's method of forming eyelets of wire answers a similar purpose. By the use of either of these methods, the jaws may be opened for cleansing the teeth or if occasion should demand opening the jaws for some other reason, without interfering materially with immobilization, since the bar wired to the teeth tends temporarily to preserve the normal relations. Another advantage of this method of wiring is that the jaws may be opened much sooner than by the older method, since the bar, if securely wired to the teeth, acts as a splint, which, with the callus, permits some use of the jaw without danger of displacement of fragments. Earlier mobility of the mandible prevents the stiffness of the capular ligaments, than when the jaws are held in occlusion for the full time required for complete ossification. Another advantage of Dr. Ivy's and my methods is that, in case it is necessary, on account of emesis or for other reason, quickly to open the jaws, the nurse or intern in charge may be instructed to cut the occluding wires, thereby preventing possible serious consequences. This is a remotely possible incident unless the jaw injury is only a complication in connection with other more serious injuries which demand a general anesthetic. It has been my custom in such cases to wait a few days before setting the jaw, supporting it in the meantime with a bandage or in addition wiring the bars in place, and applying the occluding wires later. Plating for immobilizing the fragments in these cases has never appealed to me. I have never used them and, in the two cases that I have seen in which plates were used, the results were very unsatisfactory. In some cases of mandibular fracture, there is no displacement. In such cases, I use no immobilization, but instruct the patient to use only foods requiring no mastication. I quite agree with Dr. Ivy that, in case of infection, an external opening should in all cases be made directly to the bone at the line of fracture, and drainage inserted. This will often prevent delay in union; also, in some instances, more serious results. Formerly, in those fractures of the mandible occurring anterior to the first molars, I used a splint, capping the teeth and cemented to them. This method permits free use of the jaw, a great comfort to the patient. Laterly, I have almost completely discontinued its use, since the extra time necessary in taking impressions, making casts, reconstructing the cast of the mandible and making the splint hardly justified. The first case I ever treated, in 1873 or 1874, I made a splint to cover the lingual surfaces of the teeth and wired it to the teeth and it answered the purpose.

RECENT DEVELOPMENTS IN ELECTROMETALLURGY OF INTEREST TO THE DENTAL PROFESSION*

By REGINALD V. WILLIAMS, Buffalo, New York

I

IT has been said that this is the electric age. Our prosperity is due in a great measure to the fact that we are harnessing and putting to work the colossal force derived from electric power or energy. For instance, the electric motors of today are said to be doing the work of 170,000,000 men. As progressive firms must employ methods of today, it seems that the same could be equally true of the work of the dentist or orthodontist.

There are undoubtedly a number of developments of unquestionable merit of which I have no knowledge; consequently, I am selecting and demonstrating only the few with which I am most familiar and which I believe to be of most interest to you.

Taking up first the subject of soldering, welding and brazing: In the event that you have forgotten the distinction between these different methods of uniting metal, I shall make a brief explanation. A braze denotes no penetration of the metal. A weld is a union of metals in which there is an actual penetration so that the identity of one metal is lost in the other. A soldered joint in the work of the orthodontist might be either a weld or a braze. Theoretically, and actually in practice, it is more of the nature of a braze.

Previous work on soldering brought out the fact that, contrary to general supposition, there is no appreciable penetration of solder into the average high fusing wire or orthodontic metal.[1] It also brought out the fact that exceptionally few soldered joints are entirely free from blowholes or imperfections. It was found that the best unions were accomplished with the minimum of heat. This is only a logical conclusion, as it has been found to be poor practice to overheat any metal.

Soldering work in orthodontia is unique, as by far the greater portion of solder is used in the actual uniting of parts. This is in decided contrast to the work of the general practitioner, in which by far the greater amount of solder is used in the building up of bridges, filling in of crowns and general work of that nature.

In order to effect any improvement in our work, or attempt to obtain uniformly good results, we should naturally consider the possibility of electric soldering, welding or brazing. By this method, we could be reasonably certain

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Williams, R. V.: Internat. J. Orthodontia, 11: 1 (Jan.) 1925.

of uniformly controlled temperatures. A number of pieces of apparatus were with me today. It is almost identical in construction to the instruments in

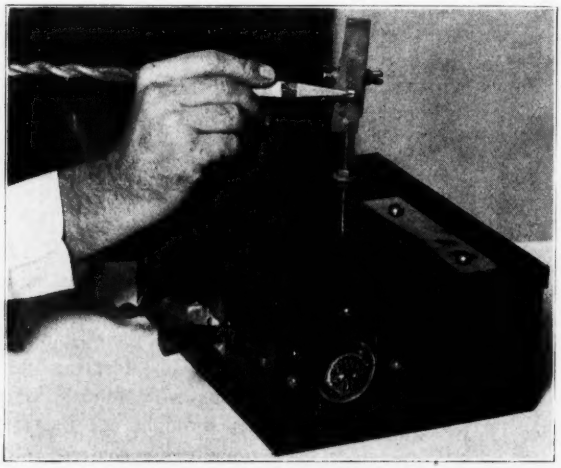

Fig. 1.—Electric soldering of molar bands. The sliding rheostat lever gives accurate temperature control from very low heats to in excess of 3,000 degrees F.

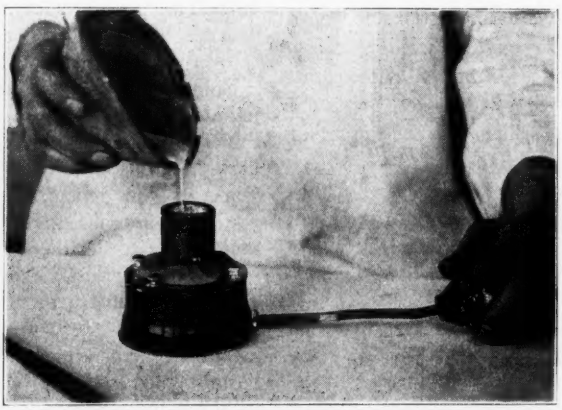

Fig. 2.—Investing a wax pattern on an electromagnetic vibrator.

constructed with this improvement in view. I have found nothing more satisfactory than the instrument I have fairly general use throughout the jewelry industry.

There has not been sufficient time to

test its possibilities by practical use in the dental laboratory. It is to be hoped that this may be done shortly.

The soldering operation is quite simple and the temperature is easily controlled by means of the built-in rheostat.

II

Research in the casting of dental restorations revealed the fact that imperfections were often due to improper investing of the wax pattern.[2] The principal trouble was due to trapped air or bubbles being adjacent to the wax pattern, with the result that they were reproduced in the gold casting.

A logical plan for the removal of air bubbles would be by a vacuum method, or by vibration or a combination of both. However, the vibration method proved to be quite sufficient for all practical purposes. The orthodontist seems to be confronted with the same difficulty as the general practitioner, only in this instance the difficulty appears to be in the quick preparation of bubble-free stone or plaster models.

The instrument which I have with me operates from any alternating current. It does not contain a single interior moving part, yet it is capable of producing, by simple adjustment of a thumb screw, a mere trembling sensation or a violent, vigorous vibration.

Fig. 3.—Pouring bubble-free models on electromagnetic vibrator.

The theory of operation is quite simple. The instrument is a compact alternating current electromagnet. It operates only on alternating current. The standard lighting current frequency is sixty cycles per second. Taking into consideration the reversals of alternating current, there will be in one second of operation at this frequency, 120 distinct motions, and over a period of one minute, 7,200. This figure represents the number of gentle vibrations capable of being transmitted to a solidifying model, or investment material over a period of one minute.

2. Williams, R. V.: Paper read before 8th District Dental Society, Buffalo, N. Y., September, 1924.

Indefinite operation over long periods of time is not injurious to the instrument.[3]

III

The last development I am demonstrating is one that I consider the most important advancement in the metal-

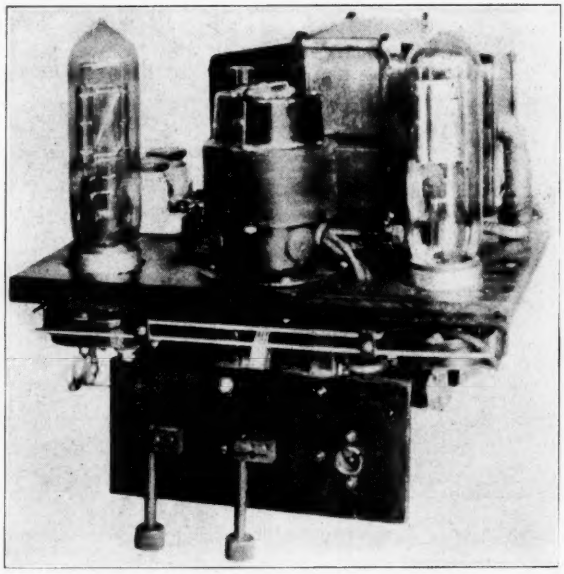

Fig. 4.—One-fourth kilowatt dental high frequency converter with box removed, showing vacuum tubes, filament and plate transformers, fuse blocks and output terminals.

lurgy of precious metal in recent years. It is the high frequency induction electric furnace, the invention of Edwin F. Northrup of Princeton, N. J.[4]

It has been proved that it is perfectly possible to make good gold-platinum alloys in the ordinary gas or oil-fired furnace. It has also been proved that the hazard of nonuniformity is exceedingly great. In splitting hairs, we might say that no alloy is completely and absolutely uniform, but the work of Matthey of London, England, clearly proved that alloys of gold containing from 5 to 20 per cent of platinum cannot be made uniform in any flame type of furnace, even after repeated remelting.[5] This is only a logical conclusion when it is considered that the precious metals are notorious

3. This instrument, also the soldering apparatus, has been delivered to E. H. Golden of the University of St. Louis, for further research and possible improvement.

4. Northrup, E. F.: Gen. Elec. Rev., 25, No. 11 (Nov.) 1922.

5. Phil. Trans., Vol. CLXXXIII A (1892) p. 629.

for their property of absorbing gases when molten; also when it is considered that the specific gravities of the component metals in gold alloys range from 7 to 21, one being three times heavier than the other, also that the fusing points range from 786 F. to, in extreme cases, 6150 F. The top temperature obtainable in the usual gas or oil furnace is approximately 2900 F. In my own experimental work, also in research in conjunction with David E. Waite, I found conclusive proof in a large number of instances in which platinum was only partially and imperfectly alloyed into the melt. Some of these results were given in a previous paper.[6] It might be argued that this is not careful or skilful melting, but any human operation is subject to errors. It is the office of the metallurgist to make possible a process whereby the best results, as far as possible, are uniformly and invariably reproduced. The high frequency induction electric furnace properly used is a very decided step forward for the betterment of the alloys of precious metals.

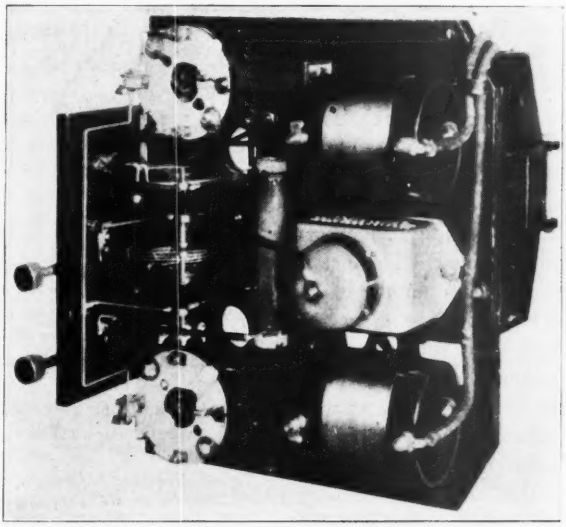

Fig. 5.—Bottom view of converter, showing grid condenser, plate condensers, oscillating circuit condenser, choke coils, grid resistor and oscillation transformer.

There is hardly sufficient time to explain and demonstrate the principle of high frequency inductive heating. The process is popularly known as "melting by wireless" or "melting by radio." The demonstration apparatus consists roughly of essential units known collectively as a converter. It is capable of converting the standard frequency of 60 cycles a second into frequencies as high as several millions a second. It is essentially a small model

6. Williams, R. V.: Internat. J. of Orthodontia, 9, No. 8 (Aug.) 1923.

of the large industrial unit. It operates at a frequency of 2,000,000 cycles a second or on a wave length of approximately 125 meters. It is the first of its kind ever constructed and was designed for use in dental casting and other dental prosthetic work. There are two other similar converters in existence. One is on exhibition at the Sesquicentennial Exposition and the other is in the chemistry department of the Bureau of Standards.

There is no fire in this process of melting, and there are no wires. The difference between ordinary wireless and this wireless system of melting lies in the fact that, in the latter instance, the receiving circuit is only an inch or so from the sending circuit. The metal we are melting comprises our receiving circuit. As a result of the magnetic flux, there is a vigorous stirring of the metal. The melting operation may be carried on equally well in any atmosphere, or in vacuum. The converter and melting attachments are the result of cooperative work on the part of the Ajax Electrothermic Corporation, the Radio Engineering Department of the General Electric Company and the Williams Gold Refining Company of Buffalo, N. Y.[7]

An apparatus of this nature is capable of melting more high fusing metals in one half hour than can a gas furnace all day long. It can melt more than 100 ounces of platinum in less than three minutes. Owing to vigorous stirring, homogeneous alloys are assured. Owing to the fact that it may be operated in vaccum, gas absorption and shrinkage cavities are easily controlled. It is capable of attaining temperatures in excess of 5,000 F. The upper limit has never been determined. Notwithstanding the fact that amazingly high temperatures are obtainable, the furnace or heating portion of the converter is room temperature or cooler. Heat is being generated only in the metal itself.

7. Byrnes, I. F.: Technical Report 17192, Radio Engineering Dept. General Electric Company, Sept. 22, 1924.

DISCUSSION

C. M. McCauley, Los Angeles, Calif.: This paper suggests for discussion three of the major problems in the manufacture and use of orthodontic metals, namely; 1. The selection of proper metals and their combination in solution in such proportions as to produce the physical properties desired in orthodontic metals. 2. The manner of bringing these metals into a homogeneous solution, making an ingot of like harmony and balance, and reducing it to wire and strips of band material without disturbing or changing the evenness of its resultant properties. 3. The shaping, bending and soldering of these metals according to our needs without depriving them of their desirable qualities. We are indebted to Dr. Black for his lengthy series of scientific experiments in selecting proper metals for amalgam alloy, and calculating their proportions to an exactness which governed variations in physical properties of his product. To Dr. Weinstein, orthodontia is indebted for similar work in preparation of our metals. Problem 1 has, therefore, been very well taken care of. In Problem 2, namely, making the homogeneous solution, we again refer to the work of Dr. Black in 1895 and 1896. He it was who called our attention to the following important factors for the proper solution of two or more metals in each other: (1) melting by electric current; (2) using care not to overheat; (3) agitating and mixing thoroughly by stirring. The electric current has been employed in alloying low fusing metals, using a platinum wound crucible. The higher

fusing metals used in orthodontia could not be melted with such a crucible. Metallurgists have used the flame for melting their higher fusing metals and it has proved unsatisfactory. As stated by Mr. Williams, the heat of the flame is difficult to control, and the minimum degree of heat desired cannot be depended on. Results in one melt after another are not uniform. If the high frequency electric crucible or furnace described by Mr. Williams permits of gradual heating, stepping up the current at will and halting or stopping when desired; in short, if the amount of heat within the required range can be controlled at the will of the operator, then this crucible simplifies and perfects the alloying of high fusing metals. The objectionable features of the flame will be done away with, and gold platinum alloys can be made with the same degree of perfection as has been attained in the silver-tin alloys by using the platinum wound crucible. Problem 3 consists of such manipulation of scientifically alloyed metals as not to deprive them of their desirable physical properties, such as toughness, strength and resilience. The flame has been our instrument for soldering, drawing temper, tempering, etc. Every orthodontist has seen much grief due to breaking off of spurs and other attachments, breaking of arch wires and fingersprings, while bending or when in service. Molecular disturbance of these metallic substances caused by overheating was responsible for most of these ills. The instrument shown by Mr. Williams as designed to do this heating with the electric current should solve Problem 3. This brief paper solves for us two of our most difficult metallurgic problems, and should remove a multitude of obstacles from our work.

THE STATUS OF MOUTH PREPARATION FOR DENTURE CONSTRUCTION*

By M. M. HOUSE, D.D.S., F.A.C.D., Kansas City, Missouri

GENERALLY speaking, there has been much improvement in mouth preparation for denture construction in recent years. There is not so much radical removal of the alveolar process at the time of extracting the teeth as there was a few years ago. But the methods advocated by some prosthodontists and exodontists in recent articles causes me to feel the necessity of urging greater conservation of the alveolar process. More careful study of design will show that less radical methods of surgery are the best, giving Nature the opportunity of building the ridges to their final form.

The present tendency of some prosthodontists is to have all undercuts removed in order to simplify the early placement of dentures. This is extreme and, without question, poor practice in many cases. The removal of all undercuts at the maxillary tuberosities is often advised, but I feel that this is contraindicated for two reasons: (1) moderate undercuts are often serviceable in the retention of the denture, and (2) it may be more advantageously done at a later time. If removed at the time of extraction, a total collapse of the tissues may result, leaving an unfavorable base form. If time is allowed for the cancellous tissue to fill in the tooth socket, a later operation may be performed, where necessary, to remove the excessive undercut without destroying the form of the denture foundation.

Such undercuts, unless extreme, are not necessarily a menace to the early insertion of dentures, as the point of interference may be relieved on the inner border of the denture and permit of a peripherial border tissue seal.

Another and one of the most common errors that I observe is in the cases of patients with short upper lips. The prosthodontists, in general, in an attempt to prevent showing pink rubber, advise the removal of excessive amounts of the cortical plate. They often attempt to use long ridge lap teeth, with the result that a complete change in the character of expression is produced. The appearance is so marred that the patient is frequently made extremely unhappy and, in some cases, the health is impaired.

Mechanically, esthetically and mentally, this type of case is the most difficult to correct after the damage is done.

I can in no way agree with the idea that the alveolar process is a transitional tissue and for that reason should be removed at the time of extraction.

Observation of large numbers of

*Read before the Section on Exodontia, Anesthesia and Roentgenology at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

edentulous cases has revealed beyond a doubt that progressive change is not prevented by removal of the alveolar process. It has also demonstrated that a large percentage of cases have capacity for bone regeneration sufficient to rebuild portions of the ridge, if relief is made over these points and a denture base inserted promptly.

Do not get the idea that I am advocating simply pulling the teeth: such is not the case. I am advocating thoughtful conservatism; that is, the least loss of alveolar structure that is permissible with the removal of all pathologic tissue, as revealed by the radiogram, and the correct forming of the ridges for the best mechanical and esthetic results; considering at all times Nature's part in the finished result. So much for those cases in which there is the necessity of extracting the remaining natural teeth.

SOME POINTS OF INTEREST IN FULLY EDENTULOUS CASES

Since January, 1923, when I became connected with the Deaner Institute, we have given especial attention to oral conditions as they relate to the general health of the patient. You are all no doubt familiar with the previous work and writings of Russell L. Haden. Before preparing this paper, I asked Dr. Haden and Dr. Keeling, our exodontist, to go over our files and collect certain data for this presentation. This they kindly consented to do, compiling the following material for our use.

To obtain further information on the subject of residual infection, we have studied the radiograms from a series of jaws. We have also, during a bacteriologic study of periapical dental infection during the past four years, cultured a series of root tips and so-called residual areas. The radiographic and cultural studies together enable us to get some definite idea concerning the subject of residual infection after extraction.

To determine the incidence of root fragments and residual infection in our series, 200 edentulous jaws from 155 patients were examined. The number of root fragments found was eighty-six, foreign bodies, sixteen, and residual areas, five. A total of 37 per cent of the jaws examined showed one or more root fragments, foreign bodies or residual areas. The total percentage of tooth areas showing some possible evidence of infection was 3.3 per cent, and the total percentage of patients showing the same, 45.5.

The incidence of evidence of infection in the 200 edentulous jaws is evidently lower than would be found in the same number of tooth areas in partially edentulous mouths, since at least some noninfected teeth are frequently removed in the preparation of a mouth for a full denture. The percentage of jaws (37) showing possible evidence of infection is very high. One in every thirty tooth areas showed possible infection, and nearly half the individuals had evidence of possible infection. The areas suspected of possible residual infections do not show a high percentage of positive cultures. The percentage is high enough to indicate that residual infection is not uncommon, and in cases in which every possible focus of infection should be removed, suspicious areas should be investigated surgically. A high percentage of the positive areas showed definite roentgen-ray abnormalities, but similarly numerous roentgen-ray positive areas were negative on culture. In two thirds of

the cases, clinical evidence of abnormal bone was found at operation.

The positive cultures of the tooth fragments are in very much higher percentage. Forty-three of the seventy-five showed positive growth in agar. Likewise, the clinical evidence of abnormality at operation was much higher than in the residual area group. These results emphasize the frequency of tooth fragments and infected residual areas remaining after the extraction of teeth. It seems quite possible that the fault is not always with the exodontist. Often, perhaps, the patient's resistance to the organism concerned and his recuperative powers are so low that healing and the attainment of a bacteria-free state does not take place.

SUMMARY

Thirty-seven per cent of 200 edentulous jaws showed evidence of possible infection.

Three and three-tenths per cent of the 3,200 tooth areas examined showed a root fragment, a foreign body or rarefied area of bone.

Forty-five and five-tenths per cent of the 155 patients showed a root fragment, foreign body or rarefied area.

Seventeen, or 22.7 per cent, of the residual areas cultured, with sterile agar control, showed a positive growth in agar.

Forty-three, or 57.3 per cent, of the root fragments cultured showed a positive culture in agar.

The percentage of radiographic positives is lower and of the clinical positives is higher than the cultures would indicate.

More complete data on this subject will be published elsewhere.

Many edentulous patients present a history of having had numerous dentures made in the course of a year or two and of being unable to wear them with any degree of comfort. Such a patient came in at the time of the preparation of this article. He had had three sets of dentures in the past year, none of which were satisfactory. Casual examination showed the presence of two roots. A complete roentgen-ray examination of the ridges revealed the presence of twelve root fragments. Obviously, it would be impossible to make satisfactory dentures without removing all of these roots and the infected areas about them. The evidence leads to the following conclusions in regard to mouth preparations for dentures:

1. The presence of fragments of filling material and other foreign substances, impacted teeth or root fragments, and diseased areas of bone, is so common in the edentulous (nearly 50 per cent) that complete mouth roentgen-ray examination is essential in all cases.

2. The most conservative operation is indicated which will assure freedom from all infected or diseased tissue and at the same time will preserve the ridges for favorable mechanical and esthetic results.

3. A careful survey of our records shows that 21 per cent of all edentulous cases require some form of surgical preparation of the ridges for purely mechanical or esthetic reasons.

THE VALUE OF THE ROENTGEN RAY IN ORAL DIAGNOSIS*

By CLARENCE O. SIMPSON, D.D.S., St. Louis, Missouri

ANY diagnostic aid is best appraised by a quantitative comparison of its contribution with that of other methods, by estimating the relative importance of the information supplied in promoting an accurate diagnosis, by canvassing the possibilities of equitably substituting other methods, and by ascertaining the proportion of positive findings which it gives. In oral diagnosis, the data are obtained by various combinations of the following means:

1. The objective symptoms, including swelling, deformity, motor derangements and circulatory changes.

2. The subjective symptoms, in ascertaining the character and degree of pain, and the location of the disturbance.

3. The history in reference to the manifestations and duration of the disorder, previous dental operations, the nature of and the response to treatment, the age and the physical condition.

4. Ocular inspection, to observe superficial tissue changes, dental anomalies, caries and discharging sinuses.

5. Instrumental examination, to explore sinuses, carious openings and pulp canals; to test the mobility of teeth, and to apply percussion.

6. Palpation, to locate tenderness, and to distinguish fluctuation and crepitus.

7. Transillumination, to observe gross opacities and the translucence of teeth.

8. Vitality tests, to determine the response of pulps to thermal changes or electric stimulus.

9. Microscopic and bacteriologic examinations, to determine the nature of suppurative processes and neoplasms, and to study the blood.

None of these methods reveals the proximal surfaces of teeth in contact, the relation of caries or restorations to the pulp, the number and form of roots, the relative amount of the roots exposed by marginal destruction, the changes in periapical structures, unerupted teeth, unexposed foreign bodies, the early stages of destructive processes in the maxillary bones or the nature of fractures. Since most of the serious dental disorders occur in the pulp and investing tissues, the extent and importance of radiography's contribution is greater than that of any other diagnostic aid and in value approximates that of all other methods of examination combined. Excepting the acute manifestations, radiographic evidence is the most dependable guide to the effect of disease in bone, and no other preoperative method of examination can be advantageously substituted for it.

*Read before the Section on Exodontia, Anesthesia and Roentgenology at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

The proportion of positive findings from radiodontic examinations is exceedingly high, and, in adults, an examination rarely fails to disclose unsuspected disorders requiring correction.

The most significant revelations of radiography in prophylactic service are caries in the proximal surfaces of teeth and incipient marginal destruction. The consequence of this information is evident when the results of ignoring it are considered. Caries in the proximal surfaces of teeth is likely to endanger the pulp before producing pain or being discovered by the customary instrumental examination. The prompt repair of teeth attacked by caries will eliminate the pulpless tooth problem, with its operative difficulties and health risk, and radiography offers the most efficient means of investigating the inaccessible and susceptible proximal surfaces. Pyorrhea alveolaris causes the loss of more teeth than all other disturbances, and the early discovery and correction of the etiologic factors is the most effective treatment. Localized periodontal lesions, the usual origin of pyorrhea alveolaris, are demonstrable in an incipient stage by systemic radiodontic examinations. In periodic examinations for prophylactic service, these degenerative changes are readily observed, and often the primary cause, which may be a defective restoration, lack of proximal contact, calcareous deposits or abnormal occlusal stress, is radiographically evident.

The most spectacular and vital service of oral radiography is in disclosing periapical involvement from septic teeth without subjective and objective symptoms. The prevalence of pulpless teeth, and the tendency of such teeth to become septic foci, render accurate diagnosis essential in determining the probability of infection of dental origin. Obtaining the evidence to reveal or exclude the indications of periapical infection is the most exacting phase of oral radiography. The usual radiodontic examination is grossly inadequate for the purpose of deciding the individual status of teeth, and the value of radiography in this connection cannot be judged by the prevailing inferior standard of radiodontic practice. Until there is an insistent demand for a thorough radiographic examination of the teeth and investing structures, instead of the customary pretense which is deceptively called "x-raying the teeth," the diagnosis of periapical disease will be merely conjecture, with a high proportion of error. When the radiographic data are confined to crudely distorted images of the teeth, traces of canal operations and extreme disparities in radiability, accurate interpretation is precluded.

Mathematical precision cannot be expected in periapical diagnosis, but radiographic evidence is the most reliable index of structural changes, and, when fully utilized, it compares favorably with the efficiency of other dental and medical diagnostic methods. The study of periapical abnormalities is of paramount importance to investigators who endeavor to determine the pathogenic potentiality of teeth rather than radically condemning all pulpless teeth. Instead of questioning or depreciating the value of radiography in locating oral foci, we should direct intensive efforts toward gaining all the information obtainable by this means and correctly interpreting the evidence for a rational diagnosis.

SOME OF THE CONDITIONS THAT INCREASE THE HAZARD OF SURGICAL PROCEDURES*

By EDWARD H. HATTON, B.L., M.D., Chicago, Illinois

A VARIETY of experiences have contributed to the ideas that are advanced in this paper; namely, an association of eight years as a coroner's physician in Cook County, Illinois, in the investigation of more than 10,000 instances of sudden or accidental death; contact with efforts made in conducting so-called periodic health examinations; many associations with surgeons as a result of the practice of medicine, and certain relationships developed in a teaching experience in dental and medical schools in the preparation of men for the practice of surgery and the surgical phases of dentistry.

The first idea is largely axiomatic among physicians; namely, that accurate diagnosis is the most difficult and baffling phase of the practice of the healing arts, and that this difficulty is equally great in the appraisal of the health assets of a prospective surgical patient. In other words, there is no known method, even that of the complete physical and laboratory examination, the results of which may be depended on with absolute assurance. Such an examination, of course, is out of the question in estimating the risk that a patient assumes in submitting even to an ordinary major operation and is, therefore, not discussible in preparing patients for mouth operations mostly under gas and local anesthesia. It is because there is no infallible method of determining surgical risks that ways and means that fall far short of the complete physical and laboratory examination are proposed for your consideration.

The dangers that confront any operator must be assessed before an analysis can be made of the means at hand to recognize them before operation. These dangers are, no doubt, well known to you; namely, operative and postoperative shock, even accompanied by sudden death during or immediately after the operation; operative or postoperative hemorrhage; postoperative infections, and a defective metabolism associated with delayed or defective healing of the wound. The first condition is most often associated with cardiovascular impairment accompanied either by renal complications or by derangements of the glands of internal secretion; the second, with jaundice or an altered blood-clotting mechanism, and the third and fourth, with diseases of metabolism, senility or such diseases as tuberculosis or syphilis.

Of the methods available to gather such information quickly and with the expenditure of comparatively little energy, it seems to me that the simplest

*Read before the American Society of Oral Surgeons and Exodontists, Philadelphia, Pa., Aug. 21, 1926.

are the best, and that, after all, they not only have this virtue, but they are also the most reliable. Many of the items may be secured by an assistant in compiling the patient's history, such as shortness of breath on comparatively slight exertion; marked recent changes in weight; marked deviation from average weight, especially noteworthy obesity; marked pallor of the mucous membranes, a tendency to bleed persistently from trifling wounds, and a tendency to nocturia.

In compiling such histories, it would seem worth while to pay some attention to the question of inheritance, especially as it may relate to the presence of bleeders in the family, the commonness of sudden death and the tendency of the family to cardiovascular disease and rheumatism. Hereditary hemophilia is such a well known condition that it does not require further discussion. It does seem true that families possess rather definite tendencies with reference to longevity and the susceptibility to sudden death and cardiorenal disease. Such ideas have been discussed recently by at least one investigator in the dental field, Weston A. Price. On this account, repeated occurrences of any of these conditions in the family of the patient under consideration dictate a more cautious type of procedure in such instances.

There are at least three simple tests that have unusual merit in eliciting information bearing on these points: the determination of the pulse rate and its behavior as the result of moderate exertion, and tests as to whether shortness of breath is caused by comparatively slight exercise or customary activity, and whether there may be inability to hold the breath for more than ten or fifteen seconds. A similar idea has been adequately but briefly presented by S. Calvin Smith:[1]

> The preclinical stage of heart embarrassment can be reduced to five symptoms, of any one or more of which the patient will complain. These five symptoms include shortness of breath, heart hurry, chest oppression and physical fatigue, all attendant on moderate or accustomed effort. The presenting of such symptoms warrants the most assiduous search both of the heart and elsewhere throughout the body for the cause of these early heart protests.

In obtaining the history of the patient, especially at the middle decades of life or beyond, some attention should be paid to two general trends of complaints that are usually referred by the patient either to the heart or the digestive system. It is almost axiomatic among practioners of the old school that these complaints are of significance, but that they deserve an interpretation entirely different from that put on them by the patient. If the story of chronic indigestion has any merit it should direct the attention of the examiner to the condition of the cardiovascular system. This is so true that by far the greater proportion of the cases of sudden death that are popularly reported to be the result of acute indigestion are not due to indigestion at all, but to heart disease. The nerve supply of the heart and stomach are so closely related that digestive disturbances are either caused by reflex irritation or, perhaps, by the embarassed heart. Persistent unexplained pain in the right upper quadrant of the abdomen is not necessarily an evidence of abdominal disease, but is often associated with an inefficient heart, causing a passive hyperemia of the liver.

1. Smith, S. C.: The Preclinical Stage of Heart Disease, J.A.M.A., 86: (June 15) 1926.

Smith also discusses this point under the head "Acute Indigestion Fallacy."[1]

> Patients frequently assert that the foregoing symptoms are relieved by belching, and that therefore the heart protests are due to "gas pressure on the heart". . . . . Acute indigestion is a favorite newspaper headline elaboration of the same idea, grasped to explain the sudden cardiac deaths of prominent men. . . . . "Indigestion" is the black beast of the cardiologist, and the most difficult of all obsessions of which to rid the patient, once he has evolved this satisfying concept. . . .
>
> So why permit this "gas pressure" delusion longer to encumber a patient's thoughts and lull him into a false sense of security? Surely, it is more logical to assume that decomposition of food occurs because the heart is incapable of supplying the stomach with blood sufficient to elaborate digestive juices or motivate the stomach; or one might adopt the hypothesis that the heart is embarrassed reflexly by way of the pneumogastric nerve, which supplies both stomach and heart. Whatever the underlying cause might be, it is a clinical fact that when a heart can be embarrassed by "gas pressure" there is usually something wrong with that heart.

Poor surgical risks in the earlier decades of life are found in individuals who are either the victims of disturbances of the glands of internal secretion or afflicted with some generalized disease such as tuberculosis. To the former belong those in the thymus group, a condition usually described under the title status lymphaticus. Contrary to widespread belief, the members of this group are not all children; many young adults also belong to it. A considerable number of the sudden deaths in water that are usually attributed to drowning occur in individuals that belong to this group. It is also true that in a large number of the sudden deaths that occur under general anesthesia, the patient was of this same class. In my own experience, this condition has been more common among young male adults, and if this is so, it is fortunate, for the condition may be diagnosed in the young male by a tendency toward certain female secondary sex characteristics, such as the female type of figure and scantiness of the axillary, body and facial hair.

If I suggest that the operating dentist should make himself familiar with the alterations produced in the physical appearance of people by the various diseases of the glands of internal secretion, it will lead to the criticism that this is requiring too much of him. Of course, this is true if it extends to the details of such changes. Yet so much information of importance to him can be derived from a superficial inspection of his patient that some information of this kind seems to be distinctly worth while. He should, at least, know the stigmas of pituitary disease as illustrated in acromegaly and certain types of obesity; hyperthyroidism and the protruding eyeballs that go with it; and the pigmentation that accompanies suprarenal disease (especially of the mouth mucous membranes).

The interrelationship of these easily observed signs and symptoms and others usually considered of more value and of more vital significance in the determining of health conditions can be obtained from a comparative study of data accumulated in the examinations of groups of individuals. The instances I am mentioning are taken from the results of so-called health examinations. In one such group, the outstanding serious conditions that were discovered in a group of a little over fifty were high blood pressure; albumin in the urine, in one instance associated with casts; diabetes, and syphilis. In no instance, proceding on the basis of the simple tests previously suggested, would a serious

condition fail of detection, although the actual diagnosis would only have been suggested. On the other hand, there were cases of poor risks which, on the basis of stethoscopic examination of the chest, blood pressure tests, urine examinations, Wassermann tests and blood cell counts would have been missed. The interpretation of the questionable traces of albumin in the urine is helped by a study of the five symptoms already mentioned.

While it is probably not within the scope of this paper to suggest what should be done with the patient that, on the basis of such an examination as is here proposed, is labeled as an extra surgical risk, the best procedure would seem to be to consider unfavorable findings not as a red light stop sign but rather as a yellow caution sign. This conclusion is also suggested by Phelps.[2] Part of his summary is quoted:

1. All the patients without symptoms and without signs of cardiovascular impairment withstood the strain of a major operation.
2. All the patients with mild symptoms and signs of cardiovascular impairment also withstood the strain of a major operation.
3. Of six men with advanced symptoms and signs of cardiovascular impairment, three died; in two, operations were curtailed; one did well.
4. Transfusion of whole blood is the most effective method to prevent and combat surgical shock.
5. The hazard to patients with cardiovascular impairment undergoing long, severe operations is minimized by transfusion before and after operation.

Of course, it is supposed that once a patient is found to be an extra surgical risk, it is not within the province of the dentist, except those men who have medical degrees, to proceed further without medical assistance.

2. Phelps, A. E.: J.A.M.A., 86: 1824 (June 12) 1926.

There are two items that do not seem to be covered exactly by my subject, and yet I cannot pass them by without some discussion. One concerns the medicolegal hazard of doing surgical work on patients under the influence of a general anesthetic, or even in some instances under local anesthesia. Just as I am writing this, there is a short story in the *Chicago Tribune* of a dentist charged with assault on a patient while she was under the influence of gas anesthesia. And such instances are not uncommon.

Such charges grow out of hallucinations associated with anesthesia, and dentists need to guard themselves from becoming involved in such uncomfortable situations. Protection is not difficult, consisting in providing witnesses to all such operations, with the further precaution that case histories are so kept as to furnish an adequate record of such attendance. When one has a regular office attendant, this is easy. In other situations, the door into the waiting room may be left open, or some similar precautions taken. The record should be completed and the attention of the witness be called to this last step.

The second deals with the control of hemorrhage from surgical wounds and indeed with the completion of the postoperative records of all surgical cases including simple extractions. I know of nothing more annoying than to be informed at 1 or 2 o'clock in the morning that a patient is bleeding from an extraction or other wound, but it is part of the price that is paid by those who do surgical work. The responsibility that one assumes in doing a surgical operation compels him to make the best of such a bad situation even though he can do nothing more than press a piece of gauze into the bleeding

socket with one hand while he holds the telephone receiver in the other and calls for assistance. It is hoped that he will have exhausted all his resources and at this stage of the crisis, will have his patient moved to the nearest (or any) hospital if that is possible. Both the operator and the patient owe it to themselves to insist on the reexamination of all surgical wounds until the operator can enter into his record the satisfactory phrase: "discharged, completely healed," or some similar satisfactory notation indicating that the case has been disposed of in a manner satisfactory to all concerned.

Two complications in a general way should be anticipated, if possible, at the time of the preliminary examination: secondary infection and retarded or inhibited healing. Individuals with diabetes or a low sugar tolerance, for example are very likely to have infections develop even in clean wounds. Here, the previous history of infections, an unexplained loss of weight and similar items in the history are sufficiently enlightening.

You will probably have noted by this time that throughout this paper nothing has been said about the necessity for making urine examinations, the taking of blood pressures, the use of the stethoscope, hemoglobin tests and blood cell counts. These are all valuable but, on the whole, sufficiently complicated to be avoided, if possible. There are two tests that have significance and, if used when indicated, are extremely helpful. One is the clinical temperature and the other is blood coagulation time.

The taking of blood coagulation time is not necessarily difficult and may be performed without expensive apparatus. A simple way is to use ordinary Pasteur pipets in which to collect blood from the ear or finger. The pipets are then immersed in water at body temperature in such a way that the blood cannot escape or water enter the capillary end. By breaking the end off the tube every minute or two until the blood is coagulated in the tube, the coagulation time can be arrived at closely enough for all clinical purposes.

The diagnostic items that I have chosen to emphasize in sizing up the risk in operating on a given patient are:

1. Pulse rate and its relationship to exercise.
2. Gain or loss in weight; marked overweight or underweight.
3. Color of the mucous membranes.
4. Clinical temperature.
5. Elicitation of dyspnea on slight exertion.
6. The length of time the breath may be held.
7. Nocturia or overfrequent urination.
8. The hereditary factors in the family history.
9. Physical inspection.

DISCUSSION

Boyd S. Gardner, Rochester, Minn.: Because of the important rôle played by surgery in the elimination of infection, papers such as Dr. Hatton has presented are attracting more attention in the dental profession. In past years, patients, to a large extent, have sought the dentist for relief of dental pain only; today, patients are being referred to dentists by physicians in order that they may assist in making examinations and perform the operations necessary to remove oral infections. In this type of work, there is an added responsibility for the dental surgeon, for he must choose the anesthetic, determine the extent of operative procedure to be carried out at one time, and attend to the necessary preoperative and postoperative care. The whole trend of Dr. Hatton's paper is to the effect

that the operator should know more of the condition of his patient, and I believe every member of the society is in accord with this. We know that in the larger number of surgical operations performed by the dental profession, no history of the case is taken, and no general examination made. It appears that before a change can be brought about in this respect, the teaching of undergraduates in dentistry must undergo a radical change. Students must be taught to take histories, and the importance of cooperation with competent physicians in order properly to handle patients who are poor risks should be emphasized in their training. The physical findings of the patient should, in a marked degree, decide the anesthetic as well as the limits of the operation at one time. Notwithstanding the objection to block anesthesia by some writers, it is safer than general anesthesia. This fact has been borne out in the Mayo Clinic, by statistics not only from the section on dentistry, but also from other surgical sections. In brain surgery, Dr. Adson reports a much lower mortality rate with the more general use of local anesthetics. What is true in the management of patients undergoing general surgery is also true of the surgery of the mouth. That the postoperative result obtained by the use of a general anesthesia is better than when a block anesthesia is used may be true in certain cases and for certain operators; but it does not hold true when one has access to complete preoperative and postoperative data on many thousands of cases so managed. Dr. Hatton has called particular attention to severe heart complications, and it might be added that, particularly in angina pectoris, the operator is dealing with definite risk and must seek the cooperation of a competent physician; if possible, one who is acquainted with the patient. Rest before the operation, as well as after, is very important. In fact, such persons ought not to be subjected to even the exertion of walking from a bed to an operating room, unassisted. The patient's ability to hold his breath has not proved a satisfactory criterion of the cardiac condition. It is well recognized that angina pectoris is a serious syndrome confronting the physician and causes most of the sudden deaths from cardiac disease. Quoting from Barnes: "The operative risk due to cardiac disease depends on the history of the patient's response to effort. If effort is not followed by unwarranted dyspnea, pain or *tachycardia with edema thereafter*, the heart is compensated and operation may be safely undertaken." Perhaps not as much attention is paid to the temperature of dental offices when general anesthetics are given. It should be emphasized that loss of body heat shares, with prolonged anesthesia and loss of blood, an important place in the production of shock. I think that that is often overlooked by dentists in giving long general anesthesia in their offices. They may be quite warm themselves and for that reason the window may be open, but the temperature of the patient is all-important. It is necessary to keep up body temperature in order to lessen the shock. Regarding hyperthyroidism, and again quoting Barnes: "It has long been a custom at the Mayo Clinic to refuse operations of all kinds to patients suffering from hyperthyroidism until the latter condition has been relieved. The only exception to this rule is in cases in which strictly emergency operations are required. It is a well substantiated observation that if the patient suffering from hyperthyroidism, even so simple a measure as dental extraction may aggravate that disease to an alarming or uncontrollable degree. Plummer and Boothby have pointed out the greatly increased safety that can be conferred on a patient with exophthalmic goiter by preliminary preparation with compound solution of iodin, U.S.P. As one considers that pratically all teeth are removed in dental offices rather than in hospitals, it is evident that postoperative care in a large percentage of cases is sadly neglected. If a general surgeon performed operations which carried a risk comparable to that of some of our operations, he would not think of having his patients report to his office the next day but would make the necessary call on them. It seems that a certain precedent has been established that makes it quite necessary for all dental patients to report in person to dental offices the day following operation, and if they do not, a note is generally made to the effect that the patient did not follow instructions. This does not excuse the operator from his responsibility.

A. E. Smith, Los Angeles, Calif.: Dr. Hatton's paper should be read a number of times not only by the surgeon but also by the dentist. After the physical examination has been made and the blood pressure determined—when all physical findings, in other

words, are analyzed, the anesthetic should be selected in accordance with the findings. We shouldn't try to fit the patient to the anesthetic, which should be carefully selected and given in a skilful manner because the outcome of the operation, the postoperative complications, rest not only on good surgical technic, but also on the careful administration of the correct anesthetic and accurate diagnosis based upon a knowledge of conditions. It is impossible for an operator to make a diagnosis of the case unless he is thoroughly familiar with the various pathologic conditions. Dr. Hatton has brought out the various general abnormalities or constitutional derangements wherein the surgical risks are greatly magnified. Among these are diabetes, tuberculosis, syphilis, hyperthyroidism, and advanced cardiovascular changes. The average dentist thinks it is too much bother to go into the details that Dr. Hatton has outlined. Many of the tests along diagnostic lines can be made by dentists whether or not they have had a special training in pathology; such as the taking of blood pressure, and determination of the general physical condition and the condition of the mucous membrane. When the dentist recognizes that there is something pathologically wrong with the patient, he should consult a good pathologist, as a protection to the patient as well as to himself. If all three cooperate, the best results will be obtained. The responsibility of the operator, as Dr. Hatton has brought out, does not lie alone in the operation, but also in the postoperative complications. The operator should keep track of his patient from the time of operation until he knows that the patient is out of danger. If he makes an appointment for the patient to return to the office, his responsibility is ended, but to fail to follow up a case and use due care in postoperative treatment is unwise and portends trouble.

H. A. Elmquist, Des Moines, Iowa: The same precaution should be taken in using a local anesthetic as in general anesthesia. The impression that may prevail that it is only dangerous to give nitrous oxid and that procain is a "fool-proof" anesthetic is erroneous. Two deaths occurred in an eye, ear, nose and throat office near mine, due to procain. We must realize also that there is somewhat of a surgical shock from our operations even under procain. The patient's condition on the third or fourth day is more of a criterion than on the same day or the day after. Often a patient under procain anesthesia will complain of not feeling quite so well on the third day.

M. F. Howard, Denver, Colo.: One of my patients, while he didn't have a very fine physique, didn't look very sick. After he was examined, and radiograms had been made, several impactions, one or two large granular areas and one cyst were revealed. When I advised that extraction would be necessary, the patient said, in a quiet way, without much concern, "Well, do you want to do this operation now?" His lack of interest in contemplating an operation that represented a difficult performance was so unusual that I began to investigate his general condition, and I found an advanced case of tuberculosis. Since that time, when a patient manifests a lack of interest in a difficult operation, I am concerned about the physical condition and go into it more than had been my habit previously.

J. P. Henahan, Cleveland, Ohio: One feature of this paper might, I think, produce a result not intended by the author. There is evident a tendency toward pessimism throughout, which might create a feeling of dread in the minds of men who may be contemplating the employment of nitrous oxid and oxygen in their practice. I see no need for creating any such feeling. Although it must be recognized that, in all forms of general anesthesia, an element of danger is always present, it must also be realized that, today, there is less danger in connection with the administration of nitrous oxid and oxygen than formerly because of the greater knowledge which exists. Dr. Gardner's discussion might be interpreted to mean that he regards nerve block or local anesthesia as a panacea for all anesthesia difficulties. I am not a crank on any form of anesthesia, but I am forced to realize that the careful selection of the anesthetic for any given case may be as much a scientific procedure as the administration of the anesthetic itself. One of the chief arguments heard today against the use of nitrous oxid is that it is easier for the dentist to use a local anesthetic. We should be reminded that, as yet, there is no remedy known to any branch of medical science which works equally well every time. In behalf of the local anesthetic, I will say that it has been a God-send to the suffering public

and the dental profession, but on the other hand there are many known cases in which the injudicious use of nerve block has been recognized as the cause of trouble, sometimes very grave. The ability successfully to administer nitrous oxid for general anesthesia represents years of practice in the hands of a qualified anesthetist. It is one of the safest anesthetics ever employed by the professions, and a remarkable feature of it is the limited class of cases in which it cannot be successfully used. This paper has been almost a continuous presentation of the dangers of general anesthesia, but the conclusions are based upon statistics. There has been no reference made to the millions of successful administrations of all the general anesthetics. Before we go into panic, it should be remembered that general anesthesia and the principle of asepsis are the principal factors through which modern surgery has been developed. Local anesthesia must always be regarded as a minor anesthetic. Except in rare instances, it must be used in minor cases or in conjunction with general anesthesia. Discernment on the part of the anesthetist is always necessary to determine whether a minor or a major anesthetic is to be employed, no matter what the nature of the operation. The two chief dangers of local anesthesia are the possibility of spreading local infection and making it general, or of causing psychic shock. So much has been said about the danger of spreading infection that it is not necessary to refer to it here. Psychic disturbance is one of the prime causes of shock. Psychic shock is as dangerous as shock resulting from any other cause, as it might terminate fatally. It produces, like shock of any other character, a great and sudden burden on the vital organs, with a pronounced lowering of the blood pressure. When we consider these possibilities, we would regard them as sufficient reason for choosing the anesthetic best indicated. When it comes to a review of statistics, it will be found that there is a very low percentage of deaths occurring during dental operations as a result of anesthesia. This is a remarkable tribute to nitrous oxid and nitrous oxid-oxygen, when we realize the enormous number of times these agents are employed in dental offices every day. In view of the record built up by the dental profession on the safe use of nitrous oxid, ever since the days of Horace Wells, I urge the profession toward a reawakening to the merits of this wonderful anesthetic and recommend that they employ it to a much greater extent than is now the case. Local anesthesia must not be regarded as something safe in every instance. When sufficient time has passed and statistics are at hand, it will be found that there are many bad results following its use. Local anesthesia, while it has been a boon alike to mankind and the profession, is not a panacea. There are thousands of cases in which it would naturally be the anesthetic of choice, but there are countless other cases where it should not be used. I wish to thank Dr. Hatton for the very exhaustive paper. I am sure that when it becomes a part of dental literature, it will often be referred to and found a source of much information.

Dr. Hatton (closing): I did not deal with statistics because in Cook County, Illinois, we can prove by coroner's statistics that the most dangerous place in the county is in bed, and the second most dangerous place is your own home, from the standpoint of accidental death. On the whole, any attempt to prove conditions by statistics has to be carefully controlled, and I have no such figures. The idea that was most repeatedly criticized in the presentation that I made was that concerning the value of inability to hold the breath for any length of time, as a diagnostic sign. This was only one of seven or eight. It has some value. You cannot rely on it alone, as the discussers suggested. In my paper I made the statement, with the hope of not alarming you unduly, that physical inability is not a red stop light but merely a caution yellow signal. I desire to caution you that, if the signs indicate poor risks you should advance slowly and proceed cautiously. The methods that I presented are not complicated, ultrascientific ways of ascertaining the condition of the patient, but rough and ready methods. Examine the patient, ask whether he suffers from shortness of breath, whether he enjoys exercise, and if he doesn't, why, and so on. Such an examiation should precede every type of dental operation under any type of anesthesia or no anesthesia in sizing up the patient as a risk. In the case that was mentioned of tuberculosis, the individual also suffered from loss of weight, marked dyspnea and the atypical relation between pulse rate before and after exercise. His condition would have been evident under

the plan I propose. The mental attitude of the patient has value, and that is a valuable suggestion. Dr. Gardner is the only discusser who actually had the paper and I appreciate the things he said. I, myself, have seen examples of brain tumors removed under local anesthesia at the Mayo Clinic, and it is wonderful. It is done there under block and local infiltration anesthesia. I want to commend the idea suggested of avoiding loss of heat, and I want to emphasize the point Dr. Gardner made that dentists, little by little, should be encouraged to make more calls on patients in their homes and not have them always come to the office. Answering Dr. Heidbrink, I don't think that we always know what the risk is under various types of operations. Certainly, if we figure on the basis of the percentage of people who die at various ages and the length of time they spend in dental chairs, sooner or later, on the basis of the laws of probability and chance, some one is going to die in a dentist's chair. In these cases of collapse under operation, you may run for whole decades without trouble, but by the law of average, sooner or later, you will have such a case.

J. A. Heidbrink, Minneapolis, Minn.: I quite agree with Dr. Gardner regarding the breath holding test. I have tried holding my breath and find it easy for the first twenty seconds, when considerable discomfort develops and progressively increases, until, at the end of a minute it is unendurable. I dare say this is quite the average experience, so in making this test the patient's ability and willingness to endure punishment must be taken into consideration and it would appear that this is quite an uncertain quantity. When procain first appeared on the market, its promoters seemed to think it necessary to discredit general anesthesia. In those days, few hospitals routinely used nitrous oxid-oxygen. Generally, it was reserved for patients who were very sick and whose operations were very dangerous and for cases in which the possible results from ether administration were feared. Naturally, under these circumstances, some startling death records were compiled. To satisfy myself as to the safety of nitrous oxid-oxygen, as administered for dental surgery, I wrote to a number of prominent dentists whom I knew had used this anesthetic extensively for many years. N. S. Hoff, then dean of the dental department of the University of Michigan, reported thirty-five years' use of nitrous oxid, both in his private practice and in the University Clinic, with no fatalities. A. Brom Allen of Chicago reported sixteen years' specializing in exodontia, using nitrous oxid (no oxygen) in all cases without any alarming results. Thomas B. Hartzell of Minneapolis reported thirty years' use of nitrous oxid with no fatalities. Laird W. Nevins reported that he had specialized in the extraction of teeth for forty years, using only nitrous oxid, and I later was informed that he had kept a record of more that 100,000 nitrous oxid administrations without a fatality. Dr. Teeter reported 75,000 anesthesias without a fatality. So it would seem that if many people are walking around in such physical condition as to be unable to undergo nitrous oxid anesthesia without fatal results, even though it is carefully administered, some such patients would have been encountered among the many thousands of anesthesia cases above reported. Occasionally, it is true, deaths resulting under nitrous oxid are reported as having occurred in dental offices. Therefore, we should exercise the greatest care in choosing and administering the anesthetic. With no experience in the field of brain surgery, I am unable to express an opinion concerning the relative merits of nitrous oxid-oxygen and local anesthesia for such operations as discussed by Dr. Gardner. In the dental field, our anesthesias are short, and the element of surgical shock is practically nil. Most of our patients are well, or at least able to walk to our offices. If the patient is hospitalized or under a physician's care, his physical condition can be ascertained from the doctor in charge and his opinion sought as to the patient's fitness to take the anesthetic. I do not wish to encourage any one to be careless in the use of nitrous oxid. On the other hand, none need be unduly fearful and fail to use nitrous oxid-oxygen where it is indicated.

A SECTIONAL IMPRESSION TECHNIC*

By M. B. RUDD, D.D.S., Richmond, Virginia

IT is a frequent experience that great difficulty is encountered in fitting a partial denture when it is completed. With those having a number of direct and indirect retainers, one side may seemingly be a fit and the other not. We make the adjustments that our judgment dictates, only to find that we were wrong. It is generally the case that, when we begin cutting, grinding and bending clasps, we wind up with a misfit. These difficulties may be largely obviated if the impression is an accurate copy of the edentulous areas and the teeth. Often, by the methods used in taking impressions previous to the one to be described, I have, owing to the patient's dislike for a mouth full of plaster, and the difficulties encountered in breaking it out, and reassembling the parts, convinced myself that the impression was good enough.

The many combinations in partial cases that we are required to treat make it imperative that a method be employed to copy accurately any one of them. There are a large number of healthy teeth inclined lingually, buccally, mesially and distally. These teeth are sometimes extracted in order to simplify the restoration. The impression technic that we will consider is adaptable to any combination or peculiarity of arrangement of teeth of any partially edentulous jaw that should be fitted with a partial denture. The time required is little more than that necessary for the split plaster impression without any of its unpleasantness or uncertainties.

The facility of obtaining an impression that is a true copy of the jaw gave me the idea that cast partial dentures could be made without the fitting of the parts in the mouth. By fitting the parts to the cast instead, both my time and the inconvenience to the patient are saved. This I have done for a number of years, with entire satisfaction. Since all adjustments were made on the cast, these cases fitted often without the necessity of touching them with stone or pliers. On the theory that a cast made from an accurate reproduction of the jaw is the same as the jaw, impressions may be made of it and castings fitted to it with far greater ease than in the mouth. Results obtained in doing this work by this method have convinced me of the accuracy of this impression technic.

CLASSIFICATION OF IMPRESSIONS

To simplify the study of partial impressions by this technic, it will be well to divide them into four classes and de-

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

scribe each. Each of the four impressions differs either in the preparation of the compound trays or the all plaster sections, or both.

Class 1. The simple maxillary or mandibular impression is one that may be taken with one palatal or lingual section and one labial or buccal.

Class 2. Those cases that may be taken with one palatal or lingual section and two or more labial and buccal sections.

Fig. 1.—Two short spatulas, 2¾ inches long, one made narrow for making small plaster sections. The end of an ordinary rubber spatula is cut off to make these.

Class 3. Those impressions requiring two or more palatal or lingual sections and two or more labial and buccal sections.

Class 4. Those cases requiring one or more palatal or lingual sections and two or more labial and buccal sections, including modeling compound cores.

MATERIALS AND INSTRUMENTS

As a preliminary to the description of a Class 1 impression, the materials and instruments used are these: black tray modeling compound, impression plaster, impression tray, mixing bowl, mixing spatula, short spatula (Fig. 1), cocoa butter or oil, cotton rolls and a small brush.

The selection of the impression tray to fit the case should be first made. For maxillary impressions, this is not difficult. Although correctly made maxillary trays for this impression technic are not manufactured, they can

Fig. 2.—Tray showing the width from the labial to the lingual flange.

be selected to serve the purpose more easily than for the mandible. Some of the requisites for a full mandibular partial tray (Fig. 2) are as follows: It should have sufficient length to cover the teeth and extend to the angle of the jaw; it should be wide from the labial to the lingual flange (not less than three-quarters inch); it should widen slightly toward the heel and have a long lingual flange at this portion of the tray; and it should have a slight upward curve at the angle of the jaw with the buccal flange short at the distal end,

tapering anteriorly to a normal length at the bicuspid region. The impression tray is used to carry modeling compound from which we design a tray. Therefore, a narrow impression tray from the lingual to the buccal flange invites breakage in the trimming of this modeling compound tray, owing to its thinness at this point.

CLASS ONE IMPRESSION

The technic employed for taking impressions of the four classes follows general lines of procedure. Therefore, in the description of each class, any detail that has been stressed in a preceding one will be omitted.

Fig. 3.—Cast with six anterior teeth only, the simplest type of which to take a sectional impression.

The description of a Class 1 impression, selecting a mandibular case with six anterior teeth (Fig. 3), is as follows:

The tray is selected and slightly oiled. Two or three cakes of modeling compound are heated and placed in it. A small part of the compound is turned over the heel and the labial and lingual flanges, after which the tray is carried to place, and the compound pressed lingually and buccally with the finger to insure adaptation. Care should be taken not to force the inner surface of the tray into contact with the incisal surfaces of the teeth. The compound is allowed to cool partially and is then removed (Fig. 4).

It must be borne in mind that this preliminary impression with modeling compound has nothing whatsoever to do with the final impression, except as far as the compound adapts itself to a quick and easy production of sectional trays in which to carry the plaster. The compound is then thoroughly chilled and removed from the tray. With a sharp knife, the labial part of it is cut away on a line parallel with the labio-incisal surfaces of the cuspids and along the incisal surfaces of the lateral and central incisors. The compound is left about one eighth inch thick above the incisal surfaces of the teeth. The buccal flanges are cut slightly shorter than the finished impression is desired to be and is beveled on the external surfaces toward the crest of the ridge. At the disto-incisal angles of the cuspids, it is cut

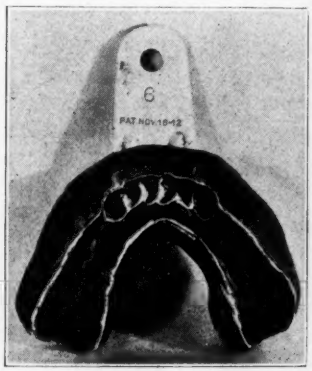

Fig. 4.—Preliminary impression.

straight downward to the center of the alveolar ridge.

The buccal flanges are cut off at the anterior ends so as to leave V-shaped spaces distal to the cuspids. The point of the V is at the junction of the crest of the ridge and the cuspids and that part of the tray is beveled. The length of the saddle portion of the compound tray should extend to the angle of the jaw and upward on to the soft tissues about a quarter of an inch.

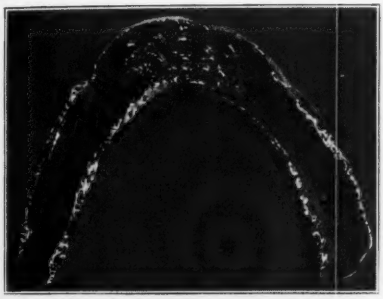

Fig. 5.—Modeling compound tray trimmed showing scarification and other preparation.

The lingual side of this compound tray should be cut short of the desired length for the finished impression. It should be thinned and beveled toward the crest of the alveolar ridges distal to the cuspids. The anterior lingual part of the tray is left slightly thicker than the posterior and tapered toward the incisal edges of the teeth where it is left broad and slightly beveled labially. It is now tried in the mouth, and any additional trimming that may be needed is done. The interior of the tray, including the imprints of the teeth, is thoroughly scarified (Fig. 5).

The plaster is thoroughly spatulated, care being taken not to have it too thin. The tray is dipped in water, then into

Fig. 6.—Lingual plaster section. The thickness of the compound over the incisal area of the teeth may be noted.

the plaster, sufficient being added to insure a surplus, and is then carried to place. The patient is told to protrude the tip of the tongue slightly and close gently on it. When the plaster has set, the tongue resumes its normal position, and the operator places a large cotton roll an inch and a half long under it, to

Fig. 7.—Lingual and labial sections.

absorb the saliva and occupy the patient's attention. Fresh rolls are added when necessary. The surplus plaster on the

labial surfaces of the teeth and also just distal to the cuspids is removed. With a small brush, these surfaces are oiled. It should be remembered that teeth wet with saliva do not need oiling. A small mix of plaster is made and allowed to stiffen until it will stand up on the short spatula and not flow over the edges. This is placed between the teeth and lip and, with gentle pressure of the lip, forced into place. Care should be taken to carry it up and over the compound tray but not downward toward the tongue; also not to thin the plaster section too much.

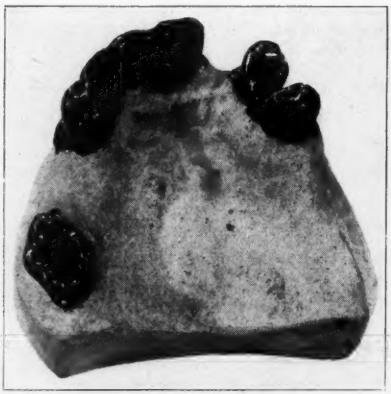

Fig. 8.—Cast in which the number and location of the teeth necessitates the shaping of the tray differently from that of Figure 5. More all plaster sections are also required.

The plaster is allowed to harden thoroughly, then the all-plaster labial section is removed. The heat generated by the setting of the plaster softens the modeling compound; therefore, it must be chilled. Cotton rolls dipped in ice water are preferable for this purpose. Then, with gentle pressure toward the tongue against that part of the compound that stands above the teeth, the lingual section (Fig. 6) may be dislodged. These sections are rinsed under the spigot, and, when they are dried, it will be found that they fit one against the other (Fig. 7). They are fastened with sticky wax.

CLASS TWO IMPRESSION

For a Class 2 impression, we shall select a maxillary case with second molar, cuspid and lateral and central incisors on the right side, and central incisor, cuspid and first bicuspid on the left (Fig. 8). The compound preliminary impression is taken as in Class 1. The compound tray is cut away bucally, the operator beginning with the right side, on a line through the occlusal surface of the molar, and continuing along the crest of the ridge through the sulci of the bicuspid, along the incisal edges of the cuspid lateral and central incisors and the cuspid, through the occlusal center of the bicuspid on the left and downward to the crest of the ridge

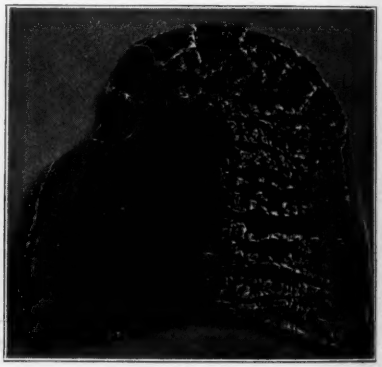

Fig. 9.—Compound tray. Note the way the tray is cut on the right, also on the left distally to the bicuspid.

distal to it. The buccal end adjacent to the bicuspid is cut away and a V-shaped space distal to it is formed. The compound distal to this point is beveled on the buccal surface and downward to the periphery. The buccal flange on the left is cut short of the desired length for the finished impression and thinned as in Class 1. The distopalatal border is cut to the length desired. The excess thickness in the vault is carved to approximately one-quarter inch for convenience in handling and to give room for the patient's tongue. The palatal side of the compound is scarified (Fig. 9), dipped in plaster and carried to place and the plaster allowed to harden. The surplus on the right side is then removed buccally and on the labial surface and just beyond the first bicuspid on the left. The first all-plaster section is placed on the right from the molar region to the cuspid, the second from the bicuspid on the left to the right central incisor. These two are beveled at their anterior ends. The third section is placed between them. If oil or cocoa butter has been applied prior to placing each all-plaster section, the removal will be easy. The third all-plaster section will be the first removed (Fig. 10). The other two all-plaster sections will follow. The compound of the palatal section is chilled and the section removed (Fig. 11) and treated as in Class 1.

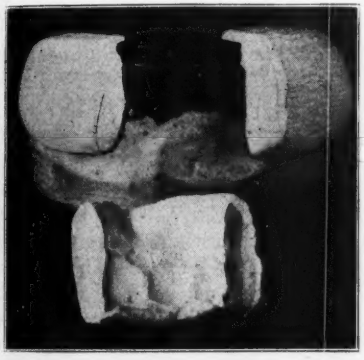

Fig. 10.—Two buccal and palatal sections in place, with the labial section removed to show the beveling of the buccal sections and their overlap on the compound tray.

Fig. 11.—The palatal section.

CLASS THREE IMPRESSION

The trays used for a mandibular Class 3 case are the long and short, wide base, swivel trays and half trays.

I shall describe a mandibular Class 3 impression, selecting a jaw with cuspid, first bicuspid and second molar on each side. These teeth are all inclined lingually, the cuspids and bicuspids distally and the molars mesially (Fig. 12).

The trays are oiled and a compound impression taken of each side. These impressions are removed from the trays

and trimmed as follows: The buccal sides are cut away on a line from the angle of the jaw along the crest of the ridge through the centers of the occlusal surfaces of the molars down to and along the crest of the ridge to the bicuspids and through the centers of their occlusal surfaces, and thence along the incisal surfaces of the cuspids down to the crest of the ridge to one sixteenth inch of the median line, where the trays are cut off. The

Fig. 12.—Case in which the inclination of the teeth makes three lingual, two buccal, and one labial section necessary.

lingual flanges are cut short of the length described for the finished impression and thinned for convenience in handling. The top of each tray stands about one-sixteenth inch above the occlusal and incisal surfaces of the teeth and is beveled as in Classes 1 and 2, and the lingual anterior end of the trays is beveled distally. They are now tried in the mouth and the trimming is completed. We now have two short lingual trays (Fig. 13). When placed in position, they leave a space one-eighth inch wide at the median line, the anterior ends beveled disto-lingually. The plaster is applied as described, and each tray is placed in position and held until the plaster sets. This necessitates a separate mix of plaster for each tray. The surplus plaster is first removed at the

Fig. 13.—Compound impression of one side showing a small swivel tray; the trimmed trays for each posterior lingual section.

median line labially and lingually. These parts of the trays are oiled and a small load of moderately stiff plaster with a narrow short spatula is placed next to the tongue and pressed with the finger into this space and to a level with the tops of the trays. This all-plaster section is cut flush with the labial sides of the compound trays. The surplus plaster on the tops of the trays and

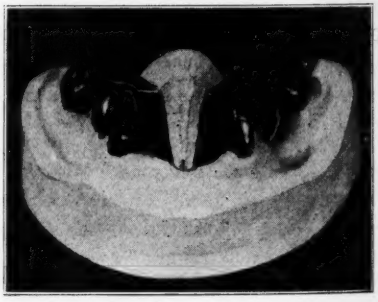

Fig. 14.—The three lingual sections in place. Surplus plaster has been removed preparatory to placing buccal and labial sections as shown in Class 2.

buccally is removed (Fig. 14). The three all-plaster buccal and labial sections now are made, the buccal sections

first, each being beveled distally at the anterior end. The surfaces of these and the parts of the main body of the impression over which the labial section is made must be oiled. Then the labial section is made.

The procedure for removal is about the same as in Class 2. If care is taken in following this technic, the sections fall in place, one fitting into the other, and an accurate impression of a difficult

Fig. 15.—Cast showing arrangement of the teeth and the spaces under two small bridges preventing the removal of an all plaster palatal section.

mandibular case will have been obtained.

A Class 3 impression of a maxillary case follows the same general outline as the mandibular. The preliminary impression of the whole or the half of the maxilla is taken and two palatal compound trays are made. Each compound tray is beveled toward the vault of the palate and cut short of meeting to about one-eighth inch, and the sections made as in the mandibular. Two palatal or lingual sections are possible in many favorable Class 3 maxillary and mandibular cases.

CLASS FOUR IMPRESSION

Often, in cases requiring partial dentures, we find fixed bridges with spaces under the linguo-occlusal side of the supplied teeth, also narrow spaces between teeth or irregularities which we wish to copy. These act as undercuts from which it may be impossible to prevent breakage of the plaster in the removal of the palatal or lingual section. We will describe a maxillary

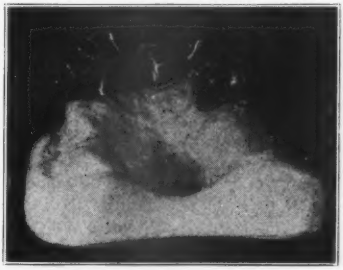

Fig. 16.—Three compound cores in position. Cross marks show the depressions in the cores.

case (Fig. 15) with the following conditions: beginning on the right, the teeth in place are the first bicuspid, cuspid, and lateral and central incisors; on the left, a central pontic, lateral, cuspid, first bicuspid pontic and second bicuspid. Between the first bicuspid and cuspid on the right is a 2 mm. space. Lingual to the central pontic is an undercut, and there is a deep undercut under the bicuspid pontic. In order to secure an impression of these spaces, small pieces of modeling compound, of suitable size for each, are pressed to place and allowed to cool under pressure. They are re-

moved and shaped so that, by observation, it will be evident that the palatal section will not be obstructed in its removal by these undercuts. A slight depression is carried on the lingual surface of each. These cores are dampened and the palatal side of each is covered with powder and forced back into place (Fig. 16) as this treatment prevents their dislodging when the preliminary impression is taken. These

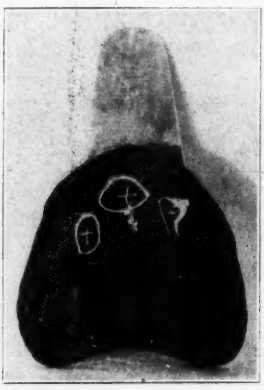

Fig. 17.—Preliminary impression taken of the cast with cores in place.

cores should be thoroughly chilled and the preliminary impression (Fig. 17) taken over them. The modeling compound palatal tray is prepared and that part of the impression taken (Fig. 18), and the same procedure followed in making the all-plaster sections and in the removal of all sections as shown in Classes 1 and 2. The cores are again chilled and removed. They are, at the proper time, in the assembling of the sections, placed in the palatal section (Fig. 19) and fastened with sticky wax.

When the sections have been assembled and fastened, at the junction of these sections occasionally small particles of plaster will be seen to have chipped off in handling. If this occurs, paraffin wax is poured into these crevices

Fig. 18.—Palatal plaster section with impression of cores marked.

and carved flush with the sections. Sometimes, the plaster of a palatal or lingual section may break from a tooth that is to be included in the design of the denture. If so, the spot should be wet thoroughly, a small quantity of thin plaster should be applied and this

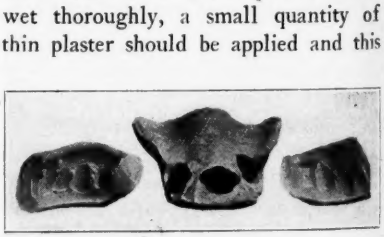

Fig. 19.—The three sections. The cores are fastened in place with sticky wax.

section be placed in the mouth. The plaster being allowed to become very hard before being removed. This will often save an otherwise perfect impres-

sion. Bear in mind that all labial and buccal sections are made altogether with plaster. The impression is completed in the mouth before any section is removed.

Many, in attempting this sectional method, have removed and trimmed the margins of the sections and replaced them prior to making additional sections. This permits error because of movement of the free section. If care is exercised in the removal of surplus plaster along the margins of the lingual or palatal sections, no difficulty will be encountered in getting good contacts. It is assumed that all who undertake impression work of any kind understand the handling of the materials used, which are those used in all dental offices. It is well, in closing, to stress again the fact that the plaster for the buccal and labial sections should be handled rather stiff in order that it may be carried to place with slight pressure of the cheek or lip.

DISCUSSION

Albert L. LeGro, Detroit, Mich.: A word picture of technic often impresses the listener unfavorably and he sometimes goes away after listening to a description such as this, thoroughly convinced that too much detail is stressed to accomplish the purpose. Possibly, without illustration or clinical accompaniment, this treatise may have lost some of its value even though it has been handled admirably, but he who follows out the directions given in this paper will add much to his accomplishments in taking impressions for edentulous areas and also for the teeth. The technic is simple and sure and requires less skill for the accomplishment of results than any other method presented up to this time. The fact that Dr. Rudd has suggested that we study the classifications as arranged by him together with the specific technic accompanying them does not excuse us nor condemn his technic if failure comes without this knowledge. When one sees the varied impressions accomplished by this particular sectional method, beautiful and perfect in detail, without fracture, each section going accurately to place, he is convinced of its efficacy. Practice is needed in this work as in all other branches of dentistry, but success seems to come more quickly. Stress must be laid on the fact that the modeling compound must be trimmed thin, for, as Dr. Rudd has said, no one section is to be removed until all are completed. A good oil to be used for this purpose is composed of equal parts cocoa butter and castor oil. It can be placed by dipping the index finger in the oil and merely smearing it over the surfaces for each section and has the added advantage of not being rubbed off easily by the tissues or dissolved by any moisture. It would seem that the most difficult part of the whole procedure of securing these sectional impressions is the mixing and manipulating of the plaster. Dr. Rudd could, to much advantage, go into detail in describing this part of his technic. He speaks of mixing the plaster rather stiff for the added sections. Such a technic with some plasters or plaster mixed with varying amounts of accelerator would be trying indeed. It would seem, therefore, that definite measurements under fixed conditions could be described to great advantage. In mixing plaster for the thin coating that is to obtain that part of the impression adjacent to the compound, much spatulation is necessary to obtain smoothness. Spatulation is known to hasten setting, and one seldom sees two mixes alike. The suggestion is made that a definite technic be developed in order that uniform results may be obtained at all times. When these impressions are run up in artificial stone, it is readily seen that stress breakers and attachments may be more judiciously conceived and engineered for the particular case, and, in addition, the perfect cast of these teeth enables the mechanic to construct the entire case on the original cast without additional impressions. Dr. Rudd has given something of great value to the profession. The sectional method comes at an opportune time in this age of partial denture and removable bridge work and is a valued addition to our rapidly growing collection of acquired accomplishments.

ETIOLOGY IN ORTHODONTIC CASES*

By HAROLD CHAPMAN, (Eng.) L.D.S., London, England

A STUDY of the textbooks will confirm the fact that not a single case is reported whose etiology is supported by a sufficient history of the case (local causes excepted). This led me to investigate about thirty cases[1] from which certain conclusions might be drawn.

The investigation included a detailed history of each case, some physical tests and some measurements. In one or the other of these cases, many, if not all, of the recognized causes of irregularities have been operative, and can be proved, directly or indirectly, to have had no effect.

The cases were selected because they presented

(1) normal occlusion exposed to reputed causes of malocclusion; (2) normal occlusion in a patient having brothers and (or) sisters with abnormal occlusions; (3) abnormal but dissimilar occlusion in brothers and sisters; or (4) abnormal but similar occlusions in brothers and sisters.

A consideration of no more than the first class of cases (those with normal occlusion, but exposed to reputed causes of malocclusion) makes it evident that the etiology of an orthodontic case requires to be most carefully considered if it is to be of value.

The conclusions drawn from this investigation were: 1. Antenatal causes, e. g., heredity and parental health, are major causes. 2. Postnatal causes are of secondary importance, except, perhaps, mastication.

In the normal occlusion cases, there is a better physique than in the others judged by the results of the physical tests. Malocclusion seems to be associated with other physical defects; which Jansen regards as evidence of "feebleness of growth,"[2] and probably a large percentage of cases of malocclusion may be so regarded, though the other evidence of feebleness of growth may be difficult to trace without thorough investigation, because the comparatively late age at our examination has given time for the body to mask or outgrow many of the more patent signs, especially if the child has been carefully tended.

Artificial feeding, the use of pacifiers, the presence of tonsils and adenoids, and mouth breathing are found

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

1. Chapman, Harold: Orthodontics: Investigations in Etiology, Dent. Rec., August, 1925; The Necessity of Complete Histories to Establish Etiology, etc., Tr. European Orthodontol. Soc., 1925.

2. Jansen, Murk: Feebleness of Growth and Congenital Dwarfism, Oxford Press; Some of the Life Properties of Bone Substance, Tr. European Orthodontol. Soc., 1924; Dent. Rec., June, 1925.

throughout the various types of occlusion in the cases investigated which were normal, Class I and Class II, Division I, cases.

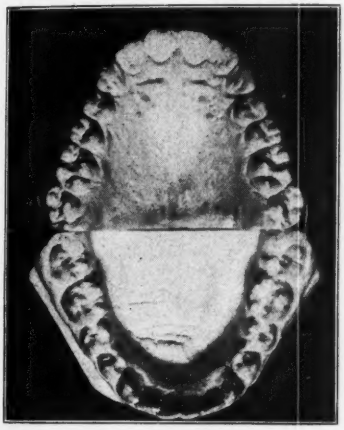

Fig. 1.—Models from first child, family A.

I have said enough to convey the necessity for full histories in orthodontic cases, if we are to arrive anywhere near

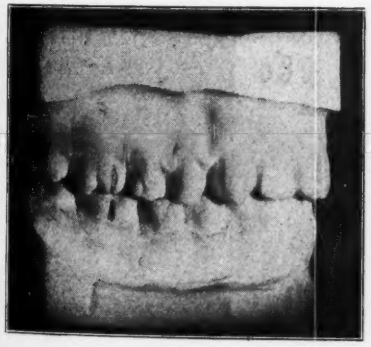

Fig. 2.—Models from first child, family A.

the truth as regards etiology. To assist its members to this end, the British Society for the Study of Orthodontics has drawn up two questionnaires, consisting

Fig. 3.—Models from second child, family A.

of two sheets for each individual, one to be filled in by the dentist, and the

Fig. 4.—Models from second child, family A.

other by the parent, and each sheet so ruled that it may be used for three chil-

dren in one family. Copies of these questionnaires and the letter sent out with them are appended.

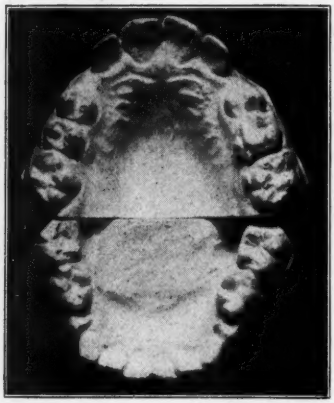

Fig. 5.—Models from third child, family A.

It will be seen that these questionnaires are exhaustive, and, in drawing them up, an endeavor was made to include all possible factors. There is

Fig. 7.—Models from fourth child, family A.

housing, environment and data regarding other relatives with similar occlusions.

Fig. 6.—Models from third child, family A.

Fig. 8.—Models from fourth child, family A.

one important omission: the physical tests, including those of the muscles of the jaws, lips and tongue, are omitted, as so few dentists possess the necessary instruments. There should be added to the questionnaires inquiries covering

I will refer to the question of mouth breathing to show the detailed informa-

tion these questionnaires call for. It is necessary to know whether the mouth breathing occurs by day or by night; also the cause, degree, age of onset, date

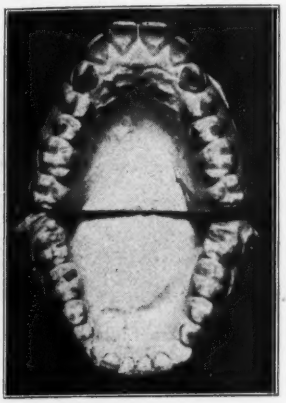

Fig. 9.—Models from first child, family B.

when nasal breathing was restored and, if several of the same family suffered, which child was most affected; etc. By this method, pursued by a large number of practitioners, a real advance in the knowledge of etiology could be made.

However, the method is not perfect; e.g., in regard to a child of 6 years, it is often very difficult for the parents to

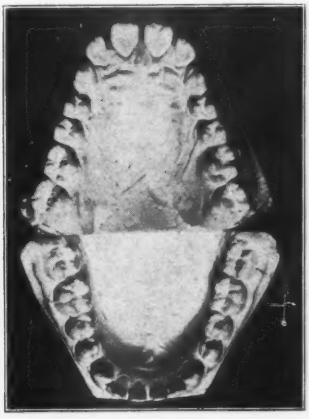

Fig. 11.—Models from second child, family B.

remember all the details asked for with any degree of accuracy; and, in a child of 12, the difficulties of obtaining an accurate history are considerably greater. The only certain way would be to write

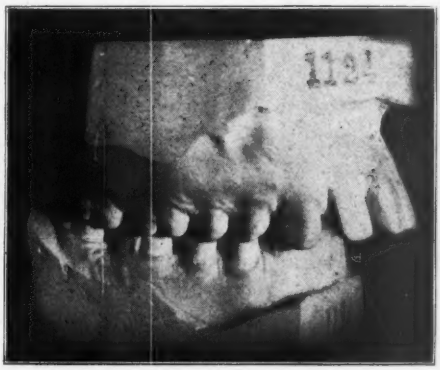

Fig. 10.—Models from first child, family B.

up a history of the child's health every two weeks or so, from birth.

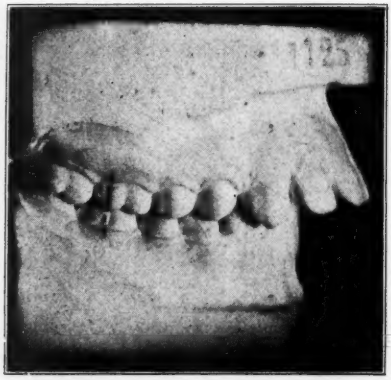

Fig. 12.—Models from second child, family B.

This is being done at the Child Welfare Centre, St. Andrews, Scotland, during the first two years of life.

Fig. 13.—Models from third child, family B.

After that, the child's record is made at the Sir James Mackenzie Institute for Clinical Research, in the same city, but at less frequent intervals. Unfortunately, there is no provision for dental

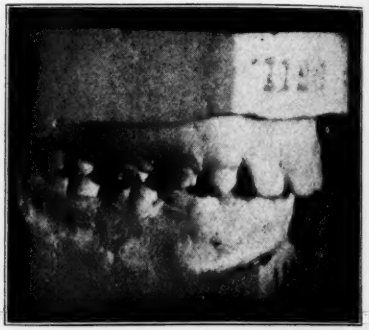

Fig. 14.—Models from third child, family B.

care or treatment of any kind for these children until they are of school age, but the histories are available for anyone who cares to consult them, and some day they should prove very valuable in any research work along these lines.

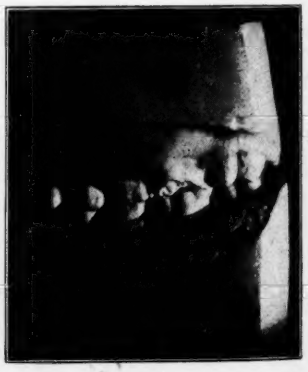

Fig. 15.—Models from third child, family B.

In illustration of the method adopted by the British Society for the Study of Orthodontics, I present seven cases in

two families, four in family A (Table 1), and three in family B (Table 2). The complete charts of these are appended. Here, I shall refer only to the salient points.

In these replies, there is not a factor disclosed to which a causative relation to the differences in the occlusion of the normal (or almost normal) ones and disclosed by the histories are negative in a similar way.

In another family of children, I have models (not illustrated here) of six, every one of whom has normal occlusion; or, in one instance, the occlusion might be described as Class I. I have never seen a family in which so many children had such good occlusion. Unfortunately, I have no history except that they are the progeny of nomads and were born on the Sussex Downs. From this, I deduce that the parents were very healthy and that the antenatal life of the children was unaffected by modern civilization.

TABLE 1.—DATA REGARDING FAMILY A; FOUR CHILDREN (FIGS. 1-8)*

	1st Child	2nd Child	3rd Child	4th Child
	No. 539.	No. 307.	No. 540.	No. 541.
	Figs. 1-2.	Figs. 3-4.	Figs. 5-6.	Figs. 7-8.
Occlusion.	Normal	Class I	Normal (almost)	Normal (almost)
Age difference.		1 6/12	1 8/12	2 11/12
Mastication.	Feeble	Medium	Vigorous	Medium
Diet after 1st year.	Inclined to be "sloppy;" lacked solids			
Mouth breathing Nasal obstruction Rickets Disturbed nutrition Habits and pacifiers	None	None	None	None

Environment: The same for all.

*The replies to the questions are for practical purposes identical for all four.

the bad Class I can be ascribed. The one factor that might be causative as regards the Class I case, and included by Jansen as a cause of "feebleness of growth," is that the child was born only 16 months after his sister. The next child was born 18 months after this one, and has good occlusion; so this factor is not at all definite in this family, and it has to be remembered that there is no question of any form of deprivation. The effects of any remaining differences

I have reported these cases not so much that conclusions may be drawn (except that etiology in the past has been thoroughly neglected), but to show that there is much scope for investigation in this field. Certainly, it appears to offer

the reward of success to those who undertake it. It is to be hoped that writers will adopt some plan, such as that outlined, when reporting cases.

Hatfield[3] says: "Advance in this field (etiology) is imperative if we are to differentiate between those cases which are susceptible of successful treatment and those which are not or, still more important, to distinguish those cases which require treatment from those which do not."

3. Hatfield, H. K.: Prognosis in Distoclusion Cases, Internat. J. Orthodont., January, 1922.

The letter sent out with the questionnaires follows:

THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS.

11 Chandos Street, London, W.1.

25th May, 1926.

INVESTIGATIONS COMMITTEE.

INVESTIGATION OF ORTHODONTIC ETIOLOGY.

Dear Sir (or Madam):

The Investigations Committee has had its attention drawn to the probability that Orthodontic Etiology has not received the consideration it merits and that the causes assigned are frequently based on insufficient evidence and inquiry. The Committee considers this subject of great importance and well worthy

TABLE 2.—DATA REGARDING FAMILY B; THREE CHILDREN (FIGS. 9-15)*

	1st Child	2nd Child	3rd Child
	No. 1124. Figs. 9-10	No. 1125. Figs. 11-12	No. 1126. Figs. 13-15
Occlusion	Class II, Div. 1, identical with that of second child	Class II, Div. 1, identical with that of first child	Class II, Div. 1, unilateral—not severe
Age difference		1 9/12 years	4 11/12 years
Antenatal factors Mother's health		Dangerous illness of elder child caused	Shock of husband's death six weeks before
(a) mental	Good	worry	child's birth
(b) physical	Good	Good	Good
Weight at birth	7½ lb.	4 lb., 14 oz.	6¼ lb.
Diet, first year	Artificial	Breast fed (?)	Breast fed
Habits	None	Sucked fingers	None
Breathing: day	Nose and mouth	Nose and mouth	Nose
Breathing: night	Mouth	Mouth	Nose
Adenoids and tonsils	Tonsillitis at 8 years	Tonsillitis at 7 years	No tonsillitis
General health	Good	Good	Good—gets cold easily
Physique	Good	Good	Slight build
Other members of family with similar occlusion	Two female cousins and one aunt. The mother believes the condition of these two to be due to tonsillitis.		

*In the two elder children, it is difficult even to suggest a cause for the malocclusion, unless it be heredity.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS
11, Chandos Street, W.1.

Histories of Children of the Same Family,
for the purposes of investigating the etiology of malocclusion.

To be filled in by the parents. Each sheet may be used for three children.

Note.—In some cases the answers are anticipated or suggested; delete the words which do not apply. Relevant information, additional to that asked for, will be appreciated.

Dental Surgeon's Name—..... *Address*—.....

Take the children in the order of their ages.

	CHILD I.	CHILD II.	CHILD III.
1. Sign or number. To indicate family to which child belongs.			
2. Child's name or number and sex.	M. F.	M. F.	M. F.
3. Race.			
4. Date of birth (age)	( )	( )	( )
5. Height.			
6. Weight.	Clothed. Unclothed.	Clothed. Unclothed.	Clothed. Unclothed.
7. Walked at.	Age. Early. Late.	Age. Early. Late.	Age. Early. Late.
8. Physical variations in infancy.			
9. Knock-knees, flat-foot or other changes.			
10. Ante-natal factors.			
(i) Father's health.			
(ii) Mother's health.			
(a) Mental.			
(b) Physical.			
(iii) Other factors.			
(iv) Normal birth or difficulties.			
11. Weight at birth.			
12. Length at birth and other measurements.			
13. Diet. 1st year: Breast fed.	How long? Vigorous. Medium. Feeble.	How long? Vigorous. Medium. Feeble.	How long? Vigorous. Medium Feeble
1st year: Artificial	How long? What foods?	How long? What foods?	How long? What foods?
2nd to 6th years.			
After 6th year			
14. Sweets.	Many Few.	Many Few	Many Few
15. Fruit.	Daily. Irregular	Daily. Irregular	Daily Irregular
16. Mastication.	Vigorous. Medium. Feeble. Rapid. Slow.	Vigorous. Medium Feeble Rapid. Slow	Vigorous Medium Feeble Rapid. Slow

Additional Information to be written in the space above.

17. Habits, i.e. sucking thumb, fingers, tongue, lips, etc. How long each day. Between what ages.	With or without	jaw movement.		With or without	jaw movement.		With or without	jaw movement.	
18. Comforter. Used between what ages. How long used at one time. If used during sleep.	With or without	jaw movement.		With or without	jaw movement.		With or without	jaw movement.	
19. Breathing. Day. Night.	Nose. Nose.	Mouth. Mouth.	Both. Both.	Nose. Nose.	Mouth. Mouth.	Both. Both.	Nose. Nose.	Mouth. Mouth.	Both. Both.
If mouth breathing, state:— 1. Possible cause.			{Constant. {Partial.			Constant. Partial.			Constant. Partial.
2. Degree.									
3. Age of onset.									
4. Date when nasal breathing restored.									
5. Which child suffered most, which least, and so on.									
20. Adenoids & Tonsils Age at which suspected. Date of operation.									
21. Nasal obstruction. Age of onset. Nature of obstruction	Present.	Yes.	No.	Present.	Yes.	No.	Present.	Yes.	No.
22. Rickets.									
23. Disturbed nutrition. Give ages.									
24. Illnesses. Give ages of occurrence of each.									
25. General Health and physique. Type of exercise taken at different ages.									
26. Inherited characteristics.									
27. Ages of children older.									
28. Age of child.									
29. Ages of children younger									
30. Father's date of birth. General health. Physique. Other details									
31. Mother's date of birth. General health. Physique. Other details.									

Type

Additional Information to be written in the space above.

BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS

11, Chandos Street, W.1.

Histories of Children of the Same Family,

for the purposes of investigating the etiology of malocclusion.

To be filled in by the Dental Surgeon. Each sheet may be used for three children.
Relevant information, additional to that asked for, will be appreciated.

Dental Surgeon's Name— *Address—*

Take the children in the order of their ages.

	CHILD I.	CHILD II.	CHILD III.
1. Sign or number. To indicate family to which child belongs.			
2. Child's name or number and sex.			
3. Occlusion.			
4. Sitting height.			
5. Nose and nostrils. Obstruction {Right. Left.			
6. Lips. Length of upper lip. Lip ridge.* Upper lip. Firm. Lower lip. Firm. Pendulous.	Long, Medium, Short, Everted	Long, Medium, Short, Everted	Long, Medium, Short, Everted
7. Tongue. Habitual position. Size. Shape. Strength.	{Contact / Lack of contact} with palate	Contact / Lack of contact} with palate	Contact / Lack of contact} with palate
8. General condition of mouth.			
9. Condition of teeth Cleanliness. Caries. Hypoplasia.			
10. Condition of gums.			
11 Natural spacing of deciduous teeth.			
12. Age of commencement of spacing of deciduous teeth.			
13. Attrition of deciduous teeth Incisors. Canines. Molars.			
14. Premature or retarded eruption of deciduous and permanent teeth			
15. Any other information			
16 Father's occlusion			
17 Mother s occlusion			

Models and, when possible, photographs to be presented. (Also models and photographs of parents when possible.) Additional information to be written in the space above or on the back.

*A lip ridge is a ridge in mouth breathers upon the gum of the maxilla or mandible, usually both, indicating where the lip rests, that portion not compressed being swollen, either as a definite hypertrophy or an œdema of the soft tissues.

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of investigation which, to be of value, must be considered by a large number of persons who are specially interested in the work, such as Members of the Society.

The Committee suggests that suitable cases for investigation are those families in which there are at least three children, one of whom has a normal occlusion; or in which all three children have similar occlusions, but the Committee has no desire to limit the investigation to such cases only.

Questionnaires (one to be filled in by the dentist and the other by the parent) have been drawn up for this purpose.

Two blank questionnaires of each kind are enclosed. A separate chart is to be used for each family. Where there are more than three children in a family extra charts should be used for that family. Each child should be given a number, and in addition each family a sign or number.

The Committee requests that the Charts, completed with models, etc., may be returned not later than the 30th of November, 1925, addressed to me—76 Grosvenor Street, Grosvenor Square, London, W.1.

Mr. A. L. Packham, The Hon. Secretary of the Society, will be pleased to furnish extra questionnaires on request being made to him at 79 Portland Place, London, W.1.

Yours faithfully,

B. MAXWELL STEPHENS,
Hon. Secretary Investigations Committee.

FACTORS IN THE CONTROL AND CURE OF PYORRHEA*

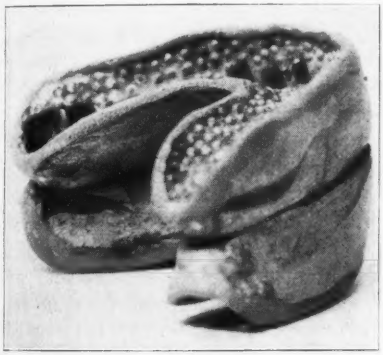
By THOMAS BRADFORD HARTZELL, M.D., D.M.D., F.A.C.D.
Minneapolis, Minnesota

PYORRHEA alveolaris, as we all know, is characterized by a slow onset and complete lack of all those symptoms that usually attract the attention of the victims of disease. Therefore, the sufferer from periodontoclasia rarely appreciates that his tissues are not normal until the disease has destroyed so much of the tooth attachment that the tooth cannot be preserved. This unfortunate state of affairs could be eliminated if every member of our profession would make it a rule to observe, as a matter of habit, and to demonstrate to each patient with disclosing stain, the fact that all surfaces of human teeth that are not immediately scoured by food in the natural process of mastication are covered by bacteria, and that these bacteria produce destructive ferments which, by their toxin, dissolve the tissues and cause the breaking down of tooth attachment. If with this knowledge we were to teach an effective means of removing or combating these organisms, not only periodontoclasia, but also tooth decay would almost cease to exist for all those individuals who grasped these facts and effectively applied them.

The control and prevention of almost all the death dealing diseases has become easy just in proportion as we have learned their etiology and applied preventive measures to control the action of their etiologic factors. From day to day and week to week, we see new victories in this field. The pathway of medicine is paved by these victories,

*Read before the American Academy of Periodontology, Philadelphia, Pa., Aug. 20, 1926.

the earliest one of which was the discovery of vaccination to prevent smallpox. Then came Pasteur's important discoveries, which enabled the prevention and control of anthrax, thus protecting the sheep and cattle industry. He saved the silk industry to France by discovering and applying the knowledge of that discovery to the elimination of the insects that destroyed the mulberry tree, which furnishes the food for the silk worm, and also saved the silk worm



Device for massaging tissues and introducing sodium ricinoleate into the gingival crevices. (J. A. Maker.)

itself from a microscopic pest. We also owe to Pasteur the knowledge that enables the control of rabies.

The results of a knowledge of the etiology of, and the preventive measures necessary to wipe out, typhoid fever furnish another example of the simplicity and ease of dealing adequately with an acknowledged scourge of human life once its cause is known. The elimination of yellow fever from the worst yellow fever region of the world, Panama, is another example of the simplicity of the control of a death dealing disease the moment we know, not its pathology, but its etiology.

Perhaps one of the greatest and latest victories is the perfection by W. P. Larson of a method of abolishing scarlet fever and diphtheria through the use of castor oil soap to neutralize scarlet fever toxin, making it possible to detoxify and administer enormous doses of scarlet fever streptococcic toxin, which brings about rapid immunity to scarlet fever in four or five days.

We now have reports from about 20,000 cases favorably acted on, mostly in children of school age, and the use of this method has stamped out several epidemics in different parts of the country. It is distinctly encouraging to see health officers in various localities of the United States at once adopt this new means for combating scarlet fever and diphtheria. In our own city of Minneapolis, we now maintain three public clinics to which children are brought for immunization to scarlet fever and diphtheria.

Not so with periodontoclasia of the pyorrheal type. Notwithstanding the fact that we have known definitely that *Streptococcus viridans* and *Staphylococcus pyogenes* are the two bacteria responsible for the destruction of the investing tissues of teeth, comparatively few dentists have accepted this fact, and still fewer have taught its application to their patients. Just why the dental profession is so slow to accept our present knowledge in the combating of periodontoclasia, I do not know.

In this type of periodontoclasia to which I refer, commonly called pyorrhea, we have slow invasion and dissolution of the gingival epithelium, destruction of the peridental membrane and resorption of the bony sockets. It

depends for its initiation and progress upon the introduction of the streptococcus into the tissues, followed by the destruction and dissolution of the surface tissues by the staphylococcus.

Now that the etiology of pyorrhea is known, the successful treatment of the disease, when once initiated, and, better still, its prevention, is easily accomplished. The successful issue of adequate treatment of this type of periodontoclasia is exceedingly easy to demonstrate either to oneself or to the patient. When a pyorrhea pocket becomes newly lined with healthy, vigorous epithelium, to the bottom of the gingival crevice, so that sterile cotton fibers may be carried down into it and withdrawn with no stain of blood or pus, and when, by the illuminating lamp, one can see the shining mucous membrane, the doubting individual can ask no more. That is my usual test of the successful treatment of pyorrhea today. No member of the dental profession need be in doubt as to whether or not he has brought about a perfect cure of a previously active pyorrhea; for he may put his work to the foregoing test and definitely settle the matter for both himself and his patient.

This result may be secured in spite of malocclusion; in spite of any of the common physical difficulties that have hitherto been looked on as etiologic factors of this disease. All types of irritation which break down the resistance of the living tissue cells and make bacterial invasion easy should be eliminated so far as it is possible. On the other hand, even though these contributing factors are not eliminated, if we stop the invasion of pyogenic bacteria, our cases are cured in spite of the presence of these unfavorable factors.

The maintenance of cure depends on freedom from continued invasion by pyogenic cocci, and in view of the fact that, up to the present time, no vaccine or diet has been perfected which establishes immunity to the activity of pyogenic cocci, and the further fact that there is no topical remedy or application which can or does produce immunity, we are thrown back on the reduction of the bacterial growth in the mouth day by day by hygienic methods combined with the use of harmless toxin neutralizers, of which sodium ricinoleate is the best example. This I first demonstrated by harmlessly administering 100 fatal doses of tetanus mixed with sodium ricinoleate to a guinea-pig.[1] It might be of interest to here show an ingenious method of quickly introducing this agent into the gingival crevices perfected by J. A. Maker of Duluth, Minn. Dr. Remensnyder of Saginaw, Mich., has much the same device, except that his device is not stippled nor does it overlap the gum to stimulate the tissues as does that of Dr. Maker. The soft rubber with the stippling presses the soft tissues as the patient bites on this massaging device. Dr. Maker has suggested and uses a vibrator to accentuate the action of his appliance, placing it between the massagers in such a way that the soft rubber massages and gently pounds the soft tissues, thus rapidly increasing the circulation and at the same time bathing the teeth with sodium ricinoleate and carrying it in the form of detoxol into the gingival crevices. The toothbrush, because of its cheapness and universal distribution, will continue to be our best

1. Hartzell, T. B., and Larson, W. P.: Neutralization of Bacterial Toxin, J.A.D.A., 12: 271 (March) 1925.

means of combating the ravages of bacteria growing on the teeth. Brushes[2] are now so constructed that the bristles may be made to reach in between the teeth both from the inside and from the outside, so that both the lingual and the buccal surfaces may be rubbed, the bacterial messes being thus scoured from the tooth surfaces and the sodium ricinoleate brought in contact with the bacteria and their toxins, thus killing many and neutralizing the toxins of all of them.

I promise the maintenance of a cure when the patient is willing to be taught the technic of keeping the necks of the teeth free or comparatively free from bacteria at the junction of the hard and soft tissue. In addition to that, he must be willing to agree to maintain that state of affairs indefinitely. In order to help him make this service to himself easy, I select brushes adapted to the individual case, always supplying some for the lingual interdental surfaces of teeth and some for the buccal interdental surfaces.[3] When teeth are leaning forward or missing, I supply two or three brushes of a type to cleanse thoroughly these more inaccessible places, and painstakingly teach the patient the use of them. I further explain to each patient that the growth of pyogenic cocci and the multiplication of pus-forming bacteria in the mouth are practically limitless, and place him under obligation to remove the accumulated growth from the necks of the teeth at least morning and evening, preferably just when he arises and again just before he retires.

I further teach that, wherever it is feasible, this service should be done to the teeth at midday. The examination of the accumulated bacterial growth on teeth shows that it is very great in the morning. A careful scouring at this time reduces the growth to a harmless minimum. In six hours, the growth will be recurrent to a considerable degree, but owing to the activity of the mouth during the day time, not so much harm is done by the accumulation during the day. It is a distinct benefit to remove what has accumulated between morning and noon. Patients who follow this practice have more nearly perfect mucous membranes than those who do not.

The patient who will effectively remove the great mass of pyogenic cocci from the teeth the first thing on rising and the last thing before retiring for the day, inserting the bristles of the toothbrush between the teeth under pressure so that the interdental sides of the teeth at the junction of the hard and soft tissue are polished bright and clean, and at the same time will make lateral friction on the gum margin, thus increasing the depth of the epithelium and at the same time giving it a toughness which is not otherwise obtained, secures for himself, by his own efforts, freedom from dental ills. Never continue the use of a brush after it becomes soft with saliva, but see to it that the patient has enough brushes to complete a fifteen-minute cleansing with a moderately stiff brush, and advise that they be not used again until they have been thoroughly cleansed, and dipped in salt water, and become dry and hard again. This lengthens the life of the brush and increases its effectiveness.

If in addition to the physical use of the toothbrush in the manner just described, one uses on the brush a prepara-

2. Hartzell, T. B.: Etiology of Pyorrhea Alveolaris, with a Simplified Treatment, J.A.D.A., 12: 1462 (Dec.) 1925.

3. Footnote 2, p. 1466.

tion of sodium ricinoleate as a scouring agent, not to exceed 2 per cent of its total bulk, he will add to the perfection of the result tremendously, because sodium ricinoleate destroys streptococci on contact and neutralizes the toxins of all bacteria immediately on contact with them.

Complete healing can be said to occur only when new epithelium extends to the very bottom of the pyorrhea pockets in exactly the same manner as in the normal gingival crevice. To secure this, we must reduce the depth of all pockets to a degree that will enable the epithelium to do this. The most effective method to reduce pockets to a depth that will enable complete healing consists, first, in making lateral friction and intermittent pressure with the sides of the toothbrush bristles thrust well in between the teeth and against the gum edges in the act of cleansing the necks of the teeth of their hourly accumulating mass of bacteria. Where the lesions bleed copiously and the root surface is sensitive, we can destroy the excessive granulation tissue, reduce the depth of the pocket and desensitize the root surface by applying ammoniacal nitrate of silver[4] to the root with thin steel burnishers, rubbing in well and following with oil of cloves. The burnisher is now heated and passed several times over the root surface previously coated, with the silver nitrate, followed by the oil of cloves. Pockets may be reduced in depth and root surfaces desensitized with great ease and comfort to the patient by this method.

The solution is prepared as follows. Place a few drops of 28 per cent stronger ammonia in a dappen dish and slowly dissolve in it small crystals of silver nitrate until the ammonia begins to appear very faintly yellow. It is then ready for use. Make it new each time. Where the root is not sensitive, phenol sulphonic acid or a preparation of sulphuric acid and cresol painlessly cauterizes and shrinks the tissues. In those cases in which shrinkage of the tissue and reduction of the bacterial growth on the root surfaces without destruction of tissue is desired, a preparation of iodin and copper is most excellent. It can be reapplied every three or four days over a period of weeks with benefit and does not interrupt the patient's use of the brush, which is a real advantage.

For maintenance of cure, we must teach our patients to inspect their own tissues regularly. We must teach them that failure to keep the necks of the teeth moderately free from bacterial growth at the junction of the hard and soft tissues is always followed by recurrence of infection and by the loss of the epithelial tissue that protects the gingival crevice. It simplifies things for the patient to say skin instead of epithelium. Loss of skin is always followed by bleeding and blood on the toothbrush demands increased effort on the part of the patient to keep the teeth clean at the junction of the hard and soft tissues.

When there has been great loss of tissue between the teeth, the use of disclosing stain by the patient is of value. The dentist should supply him with an ounce of solution and teach him how to apply it with cotton applicators made by twisting cotton on toothpicks. He should then be shown how to rinse it off quickly and look to see if there are bacteria, which he can recognize by the brown masses on the teeth. Teach the patient that finding the brown masses after

4. Method of preparation recommended by U. G. Rickert of Ann Arbor.

cleansing means faulty cleansing and that he must work harder and more effectively and spend more time on the teeth in order to keep them clean. After a perfect cleansing, disclosing stain should reveal no such brown masses. To make it still more plain, call these masses of stained bacteria mold. Say that these masses are composed largely of pus germs. Say that where the masses stand long enough, their ferments dissolve the gum and turn it into pus and that the first noticeable evidence of their activity is a bleeding gum edge, which means danger. Insist on enough "physical culture"[5] to maintain thick, strong, dense resistant skin or epithelium to ensure freedom from disease.

710 Physicians & Surgeons Bldg.

DISCUSSION

John Oppie McCall, New York City: Dr. Hartzell calls attention in no uncertain terms to what the dentist can accomplish for his patient and what they, under his guidance, can accomplish for themselves. It is a pleasure to corroborate what he claims in this regard. My own experience in practice confirms it, and I consider it the duty of every periodontist to spread this gospel among his patients. It is furthermore his duty to impress on all dentists with whom he comes in contact this truth regarding the mechanical removal of bacteria. There is probably no more important message from the dental profession to the public than that which Dr. Hartzell brings. When we come to study some of the detailed statements which he makes, we find it possible to entertain a difference of opinion. And without wishing to detract from the importance of his message, I think it is but right, in the interest of definite knowledge, that these points should be discussed. Dr. Hartzell stresses infection as the chief item in the etiology of this type of periodontoclasia. He also gives the impression that he makes a distinction between pyorrhea and other types of periodontal disease. I link these statements together because of the bearing they have on each other. My own conception of periodontal disease is that pyorrhea, as Dr. Hartzell chooses to call it, is simply the final stage in a series of disease processes in the earlier stages of which infection is either absent or plays a distinctly secondary part. To me, the etiology of the suppurative phase is, to a large extent, identical with the etiology of the earlier phases, a statement which is of course retroactive, the difference being, as stated before, in the part played by bacteria. One of the most important factors in etiology is traumatic occlusion, to which, I assume, Dr. Hartzell refers in his statement about malocclusion. Box has shown how much damage can be done to the periodontal tissues by agencies other than infection, among which agencies he lists excessive occlusal stress. The part which this agency plays in preparing the tissues for bacterial invasion is strikingly shown in his photomicrographs. And I would remind Dr. Hartzell that infection is a thing which depends not only on the presence of bacteria, but also on the resistance of the host. In other words, only those gingival tissues become invaded by bacteria whose resistance has been lowered. I do not deny that infection can be largely controlled without giving attention to the occlusion. When I first became acquainted with the possibilities of treatment as developed through the work of James D. Smith and Dr. Hartzell, I felt that my troubles with suppurative periodontal disease were at an end. But, as time went on, I found that, in the mouths of many of my patients, there was an influence at work which constantly drew these mouths down from the high level of health to the lower level of disease again. More frequent prophylactic treatment was needed to maintain health, and this in spite of what I considered, in many cases, to be a satisfactory care of the mouth by the patient. Once I had appreciated the significance of traumatic occlusion, these cases assumed an entirely different aspect. With the occlusion balanced, the problem of the maintenance of health was immensely simplified. Another aspect of the question of etiology has to do with the progression from the early nonsuppurative stages of disease to the suppurative. When the occlusion is faulty, it is my experience that, sooner or later, the tissues around the teeth will break down, no matter how carefully the surfaces of those teeth are scoured

5. Stillman, P. R.: Lecture on the mouth.

and freed of their bacterial coating. The reason is to be found partly in what Dr. Hartzell admits is the impossibility of completely removing bacteria from the tooth surface. Long continued irritation finally results in the breaking down of resistance, and infection and suppuration ensue. This brings us to the consideration of the possibilities of maintaining adequate resistance to bacteria, which is quite another matter than the removal of the bacteria themselves. Since becoming acquainted with the Charters' method of brushing the teeth, and, more particularly, since taking up the Stillman modification of this method, I have become tremendously impressed with the evident influence that this method of brushing has on the gingival circulation. Because of the latter fact, I attribute the very satisfactory results obtained to the raising of resistance rather than, primarily, to the removal of bacteria, although the latter is a point of great importance. I am therefore inclined to think that much of the elimination of, or the prevention of, infection which Dr. Hartzell attributes to the removal of bacteria should really be credited to raising the resistance in the gums. In either event, the instrument to be used is the toothbrush, and I can join most heartily with Dr. Hartzell in advocating the highest degree of conscientious and intelligent effort in the brushing of the teeth. Since receiving a copy of Dr. Hartzell's paper, I have made some inquiry regarding the possible bactericidal and detoxifying effects of sodium ricinoleate. Krumwiede states that this compound has a detoxifying power which it shares with the other soaps. He also states that the soaps, including sodium ricinoleate, are antiseptic only for gram-positive organisms. If the streptococcus and staphylococcus were the only organisms producing periodontal lesions, this would be very satisfactory, since these are gram-positive organisms. But I am not so sure that we can accept Dr. Hartzell's dictum that these organisms are alone responsible. I would therefore, hesitate to depend for health in my patients' mouths on such magical powers as Dr. Hartzell attributes to this particular soap. He draws for us a most attractive picture of the state of affairs in a mouth in which so-called pyorrhea has been cured. If closure of the former pus pocket by reattachment were impossible, I should heartily agree with him that conditions which he describes were entirely satisfactory. But I would call Dr. Hartzell's attention to the fact that it has now been demonstrated that reattachment of soft tissue to the root surface is possible. And I would also call his attention to the sodium sulphid treatment I have recently described,[6] by which a high percentage of these pockets may be induced to close. With such a standard established, we, of course, do not want the proliferation of epithelium in the pockets, nor do we want the shrinkage or cutting of tissue, which Dr. Hartzell describes. Unless the pocket is closed, the criteria of success which he establishes are to be considered correct. Observance of the program that Dr. Hartzell has laid out for us and for our patients should go far indeeed toward the control of periodontal disease.

Frank C. Pague, San Francisco, Calif.: We know that bacteria are ever present in the mouth and we should endeavor to so arm our patients with defensive thought and action that they have little or no opportunity of gaining a possible loophole about the gingival crevice. And yet, with the abnormal condition of occlusion and other irritating causes ever present, it is not to be wondered at that we are constantly at our wits' end as to how best we can overcome these causes. The etiology of pyorrhea is known; its treatment and, better still, its prevention are readily accomplished. Dr. Hartzell has carefully, and in minute detail, explained that when a pyorrhea pocket, after treatment, becomes newly lined with a healthy, vigorous epithelium to the bottom of the gingival crevice, so that sterile cotton fibers can be carried down into the pocket with no stain of pus or blood, and, by an illuminating lamp, one can see the shining mucous membrane, the doubting individual can ask no more. He advances the thought that this result may be secured in spite of malocclusion, in spite of any of the common physical difficulties that have hitherto been described as etiologic factors in this disease, and is willing to concede that all types of irritation which break down the resistance of the living tissue cell and make invasion easy should be eliminated as far as possible. On

6. McCall, John Oppie: An Improved Method for Inducing Reattachment in Periodontoclasia, Dent. Items Int., May, 1926.

the other hand, he says that even though these contributing factors are not eliminated, if we stop the invasion of pyogenic bacteria our cases will be cured in spite of the presence of these unfavorable factors. I will grant such conditions are cured, as far as appearance goes, but why take a chance, with the feeling that the patient will be faithful to his trust? To me, the defensive effort is always best; viz., the removal of the cause and complete elimination of the pockets, if the pocket has depth and there is great destruction of alveolar tissue. My first effort is toward correction of malocclusion before attempting instrumentation. Yet before I accept a patient for treatment, I obtain radiograms of all the teeth and know positively the condition of every tooth root, the depth of the pocket and the extent of pathologic conditions involved. If the destruction of the alveolus is great, the condition is cleaned up surgically, all loose gum tissue and necrosed bone about the roots being thoroughly eliminated. We frequently find, in broad deep pockets, as where a molar tooth is tipped mesially through loss of contact by extraction, a granuloma that must be thoroughly curetted to obtain healthful regeneration in the pocket. This curettement is just as necessary with the process supporting the roots of teeth as in any other bone surgery. The surgical treatment is attended with as great care as a surgeon should assume in an operation in the body to avoid infection. After all pathologic conditions are removed, the pockets are packed with a preparation of zinc oxid with essential oils mixed into a thick paste and packed into the spaces between the teeth, covering the exposed process and the gum surface is curetted about all teeth. Of course, the loss of much gum tissue is frequently apparent as a disfigurement with the anterior teeth, where the lips are short, exposing much root surface, but the result brings absolute health in both tooth and gum surface. I do not presume to treat all periodontic conditions surgically, but when the gums, both labially and lingually, have lost their attachment, and pus is discharging copiously at the gingivae, I find surgical treatment absolutely necessary. The packing is left in position for a week or ten days, then carefully removed, and the patient is instructed in brushing the surfaces of teeth and gums, so as to obtain hygienic results as soon as possible. After the first effort or two, brushing can be accomplished thoroughly, with care not to bruise or break the new gum tissue about the roots. Massage of the gums is as necessary for complete and thorough blood circulation of the gums as the thorough brushing of the teeth. Our patients should be instructed just how to do this work with the brush to obtain the desired results. In surgical work, we find that Nature has built new epithelium between the teeth and about their necks in ten days, provided the packing has been carefully placed and retained in position, covering the wound. After its removal, careful considerate attention is up to the patients, and I find them equal to the emergency. The thorough and systematic use of the toothbrush advised by Dr. Hartzell, after all irritating conditions are removed, will positively promote and retain health of the gum tissue. I use a disclosing stain on the teeth, known commercially as methylene blue, which consists of 1 per cent each of crystal violet and 1 per cent brilliant green, and 50 per cent alcohol. (Crystal violet and brilliant green are anilin dyes with antiseptic properties.) This is applied by the applicator with cotton covering one end. Besides having strong antiseptic properties, the stain is soothing and healing to the abraded surface of the gums.

THE DEVELOPMENT OF DENTAL SCIENCE AND ART IN DENMARK*

By ERNST HADERUP, Copenhagen, Denmark

ON the occasion of celebrating the fiftieth anniversary of the Danish Dentists' Association, Nov. 7, 1923, the association published a commemorative essay, which I composed.

This publication, in a chapter called "Antecedent History," gave a short summary of the development of dentistry in my country, and as these statements still hold good, the following account is chiefly based on that chapter. There is every probability that, within the next few years, a new public institute of dentistry will be created, from which we hope to obtain such an extension of professional education that it will really measure up to the claims advanced by the Danish Dentists' Association and by the directors and professors of the dental school.

Professional education has always played a prominent part in the history of the Danish Dentists' Association. We might say that in the educational problem the foundation of the association originated. A short reference to the principles of the profession of dentistry, even of olden times, would therefore seem to be a proper introduction to the history of the association. Moreover, it is worth while to bear in mind the outlines of the struggle for the professional and social rights of the dentists.

During the seventeenth and eighteenth centuries, various foreigners practiced a sort of dental profession in this country in conformity with a royal license but without any examination as to their qualifications. Their activity was mostly restricted to the cleaning and extraction of teeth and to the sale of tinctures. Furthermore, the county barbers, as it appears from the decree of June 22, 1785, Clause 12, concerning the foundation of the Royal Surgical Academy, were entitled to extract teeth. But when the probational examination (the so-called *tentamen*) was introduced, of which the oldest statements are to be found in an examination register from the year 1796, now kept in the archives of the Faculty of Medicine, a special examination for dentists was provided, probably on the occasion of the decree of Sept. 5, 1794, concerning empiricism, Clause 6 of which reads: "Inasmuch as a person, although not a physician, may have acquired excellent knowledge of some part of the medical art or superior ability in healing some disease, he may expect, supposing that the attestations of the county sheriff and of the physicians prove him to be in possession of the said qualifications, to obtain through

*Read before the Section on Dental Education at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

the government a license to practice, but only in the district where he is living, and his right to prescribe drugs is restricted to the branches in which he has proved his ability."

This clause, even up to the passing of the law on the profession of dentistry, Feb. 25, 1916, was the authority on which the government, during the intermediate 120 years, issued licenses to persons who were not "proper physicians," authorizing them to practice as dentists.

Tentamen[1] was an oral examination passed at the Surgical Academy before two professors. The above mentioned register reports as follows concerning this examination:

1. Students are to be examined by two professors, one of whom examines on the practice of medicine, the other on the practice of surgery.

2. Each student is examined during one hour, half an hour by each professor.

3. One of the following marks is given: first, meaning good; second, mediocre, and third, inexperienced.

The privilege of taking this examination was applied for at the government office, which, when the examination was passed, granted the license to practice. Many who had passed the *tentamen* did not obtain a license to practice, and, in the year 1832, the government office ceased to issue licenses for taking the *tentamen* and for practice, declaring, in reply to applications recommended by the Health Committee, March 8, 1832, among others, that: "In view of the fact that there are a considerable number of young physicians who, though they have passed the ordinary examinations and proved their ability, have difficulty in securing for themselves a means of existence by practising this profession, the government office finds it an invidious affair to grant a license for the said special profession, unless the candidate proves to possess extraordinary ability, and as this has not been stated as far as this petition is concerned, the candidate has been notified this day that his application has not been granted. On account of the circumstances mentioned in the communication of this office of the 8th inst., and also in view of maintaining the respect for the said branch of medical science, it has been considered necessary not to grant the license applied for unless in a very few cases."

The *tentamen* was thus abolished, and was not reintroduced until the year 1853, at the request of the Health Committee.

The rights of the dentists, when a license had been obtained, were rather strictly upheld, and the authorities interfered with barbers and other unlicensed persons who inserted artifical teeth. In the year 1840, a barber was sentenced for manufacturing and inserting artificial teeth in conformity with the following declaration of the Health Committee (Sept. 28, 1839): " . . . . For manufacturing and inserting artificial teeth, medical knowledge is required, in order to prevent any damage to the health of users of such teeth."

It must be remembered that the Health Committee, during the long period in which nobody was admitted to the *tentamen*, time after time explained the reasons for not holding that examination by declaring that den-

1. This word means properly "preliminary examination" (before the real examination).

tistry ought to be reserved to younger physicians. A sentence of the court of justice, June 13, 1843, approved by the high court, December 22, of the same year, acquitted an ivory turner in an action brought against him for having manufactured and put in artificial teeth.

This discharge laid the first stone of the industrial freedom of the profession.

The same year, March 2, the Health Committee sent in to the government office a legislative proposal concerning dentistry including the insertion of artificial teeth, which was to be reserved to physicians and to such persons who, after passing the *tentamen* (the health committee proposed that this probation be held before two medical professors, one examining in anatomy, the other in surgery, besides "two of the most skilful and most gentleman-like dentists of the capital"), obtained license for dental practice; but this proposal was refused by the government office's communication of March 12, 1844, referring entirely to the sentence above mentioned and declaring that the manufacture and insertion of artificial teeth could be carried on without any special license. The question about *tentamen* was not mentioned. In the year 1853, the Health Committee proposed again the holding of *tentamen* before the faculty of medicine assisted by two dentists, and this on the occasion of a petition from an old medical student; and after the matter had been discussed by the health committee and the department of justice and that of church and school, it was resolved to reintroduce the old examination. The chief reasons given by the Health Committee were that the bases for the refusal given in 1853 by the government office no longer existed, since, during the last twelve to fourteen years, no physician had practised as a dentist.

The Church and school department intended to make a proposition as to a special dental examination, but the faculty of medicine, which did not want a definite arrangement before general legislation on all medical matters became a reality, advised against the proposal.

The old *tentamen* was therefore reintroduced, and was continued until 1873. During this period, license was granted to all petitioners who had passed the examination, regardless of the mark obtained. As a consequence, the number of dentists increased rapidly, and, in 1863, the Health Committee appealed to the department to limit the admission to *tentamen* in order to restrict the number of dentists in Copenhagen, on the ground that, besides there being a sufficient number of dentists, there were so many physicians that no more persons were required for insertion of teeth. No consideration was given to these representations, but, in 1865, the Health Committee, in a report to the department of February 20, proposed to try "to bring about more concise rules for the admission to and the practice of dentistry in its full extent."

It may be quoted that, in 1865, a penal sentence was pronounced in Copenhagen against a layman who had plead guilty of having filled teeth, after burning out the pulp with a red-hot steel needle. In 1866, on a similar occasion, a goldsmith was prosecuted in Svendborg, but as he asserted that he had only filled "sound teeth" (that is, without uncovering the pulp), he was

acquitted by the lower court. Still, this serious usurpation of another of the dentists' most important prerogatives was condoned by the superior court of justice, which sentenced the accused according to the law on empiricism.

The above mentioned report from the Health Committee of February 20, 1865, had a certain success, as it resulted in the appointment of a commission on dentistry.

As regards the progress of this action, a very important chapter of the history of Danish dentistry, we quote the following statements from Hage's inestimable work, "A History of Danish Dentistry," (Copenhagen, 1886).

As the number of dentists increased rapidly during the following years, the drawbacks to the arrangement of 1853, which was considered as a preliminary one, were more and more keenly felt. The health committee, after mature deliberation, sent in a report proposing more specific rules for admission to the practice of dentistry in its full extent, which was voiced in a communication dated Feb. 20, 1865.

In this, the Health Committee draws attention to the fact that admission to the *tentamen* was not free, nor did it constitute the right to practice (which was contrary to general rules in similar cases); that there had been varying rules on these matters during the past period; that there had never been determinate rules as to the sense of average (a proposal from the Health Committee in 1862 to the effect that the "general preliminary examination" be considered a standard was refused by the church and school department), and that such was also the case as far as the sense of the term "excellent ability" was concerned. The Health Committee alleged further that the regulation of 1853 was explicitly designated as temporary, and could not be regarded as advisable in the long run. The Health Committee therefore proposed that a commission be appointed composed of two of its members, two members of the faculty of medicine and one or two dentists "of conceded ability" of Copenhagen. The faculty of medicine and the church and school department gave their support to the proposal and, July 28, the department of justice stated to the Health Committee that it was ready to appoint the commission in question and asked the Committee to select two of its members and one or two dentists of Copenhagen as members of the commission.

In conformity with the election of members made by the Health Committee and the faculty of medicine, the department of justice issued, Aug. 10, 1865, a royal appointment *ad mandatum*, for the doctor of medicine, Mansa, titular councillor of state, and the doctor of medicine, army surgeon Djorup, as delegates for the Health Commission; and for the doctor of medicine, Buntzen, professor and head surgeon at King Frederick's Hospital, and doctor of medicine, Schmidt, a teacher, as delegates for the faculty of medicine, besides the two dentists, Mr. Jansen (professor) and Mr. Didrichsen. Mr. Mansa was appointed president, and the commission was charged with the task of taking the whole matter under consideration and sending in a report and a proposal for its final settlement.

As Professor Jansen asked to be excused from joining the commission, a dentist, L. B. Bramsen, was elected in

his place by royal appointment, September 8.

The commission gave its findings, Nov. 14, 1865.

This report, referring to the report of the health commission, declared that it considered as its task legislation in the shape of a proposal for definite arrangement on the basis of the existing regulations, but so modified as to give immediate admission to the practice of dentistry to all who had passed the public examination.

The field of activity was thus defined:

1. Treatment of diseases of the teeth and gums, as well as the performance of dental operations.

2. The manufacture and insertion of artificial teeth.

The commission was of the opinion that an extensive enumeration of details would hardly be of value.

It was argued that the vigorous development of dental science had taken place independently of general medical science, and that "a more extensive medical preparatory education" therefore should not be required.

As a condition for taking the examination, it was proposed to require the general preliminary test.

While, on the whole, the commission agreed to leave it to the candidates' discretion to choose the method of obtaining his professional education, there was a disagreement on one point, because Bramsen, Didrichsen and Schmidt, in opposition to the other members of the commission, proposed as obligatory a six months' training in surgery in a hospital.

As far as the "strictly technical education of the candidate—his ability in inserting artificial teeth" was concerned, there had been no determinate rules for obtaining such training and a certificate had been sufficient. The government office, March 12, 1844, had made a ruling that it might be left to the public to decide to whom it would turn for service. The commission then proposed a practical examination, and although it did not assume the authority of proposing that unauthorized persons should not insert artificial teeth, it was thought advisable to draw a distinction between the two groups by requiring a certificate for the dentists, in the interest of the public, because, by that means, the public, "as far as possible, was secured against damage, when seeking the service of the authorized dentist."

It was then proposed to appoint four examiners, of whom two were professors of medicine, one in anatomy and physiology, the other in pathology; and two, authorized dentists, one possessing instrumental and operative knowledge; the other, technical skill. The latter had to furnish material for his examination as follows: "two persons wanting teeth in a greater or less degree." As an honorarium, he had to pay 20 rixdollars, and for the examination, another honorarium of 20 rixdollars "for purchasing a corpse and for distribution among the examiners, etc."

The findings of the commission were sent to the department of justice and from there to the health committee, who approved the proposals of the commission.

The department of justice forwarded the report to the church and school department, with the observation that it approved the report of the health com-

mission but insisted on the right to practice being dependent on special license.

The church and school department referred the matter to the faculty of medicine, whose point of view was that of the health committee.

The church and school department thereafter referred the matter back to the department of justice, declaring its agreement with the majority of the members of the Royal Health Committee, but stating that the department considered it best to postpone all changes as to both the existing rules for the admission to dental practice and the granting of certificates, until the legislation on medical practice announced by the department had become a reality. As to special license for dental practice, the department agreed with the commission that as the practice in question was dependent on the applicant's having passed an examination, technical as well as practical, and as he also had to pass the preliminary school examination, his qualifications for practice were assured, and, therefore, no special license should be required.

Partly because of the proposed modification of the whole legislation on medical practice,[2] and partly on account of the dissent between the two departments regarding the continuation of the license system, the matter was provisionally shelved by the department of justice.

The most conspicuous points of the commission's report, to the modern dentist, seemed to be the exigency of "the general preliminary examination at the university,"[3] and the stand of the minority for training in a hospital and the principle of leaving to the candidates necessary practical training. (It is characteristic that there had nowhere been mentioned explicitly treatment for preservation of the teeth.) It is equally worth noting that the whole commission declared that it would not forbid unauthorized persons to manufacture and insert artificial teeth.

During the following years, until 1870, discussion concerning dentists bore chiefly on their right to employ remedies and narcotics, and it was determined by the department, April 15, 1865, that the dentists then practicing were entitled to prescribe medicines and to employ chloroform for anesthesia.[4] After some discussion as to a more extensive *tentamen*, the department of justice, April 27, 1869, withdrew this opinion and agreed to grant licenses to dentists without authorizing them to prescribe medicine to be taken inwardly or to anesthetize without medical assistance.

April 6, 1870, the president of the former commission, Dr. Mansa, called the attention of the health committee to the report of his commission of 1865, but, after some discussion, the health

2. During the parliamentary session, 1867-1868, the government passed a bill on unauthorized medical practice. This bill, as well as various others passed in the following years by the government and by private initiative proved abortive through the disagreement as to the very principles of the measures for modification.

3. In 1862, the Health Committee proposed to replace the certificate of average preparation by a general preliminary examination of lower standard, but the departments refused such proposals. It was then proposed that the conditions for being allowed to take the examination should be a certificate of average preparation and a testimonial for technical skill issued by an authorized dentist.

4. The whole commission had proposed prohibition against prescribing remedies for outward application and against narcotization without medical assistance.

committee resolved that no further action was to be taken.

It must be noted that during all the previous efforts to establish rules for the licensing of dentists, and determining their position in law, the Health Committee had been the prime mover. But in February, 1871, we see the first concerted intervention of Danish dentists, some residing in Copenhagen, some in the provinces. About thirty dentists,[5] that is, nearly two-thirds of all Danish dentists, filed a petition to the department of justice, applying for action against the practice of dentistry by unauthorized persons and for a reform of the *tentamen.*

It will be seen hereafter that nearly every forward step in this matter later on realized was due to the initiative of or had its source in the Danish Dentists' Association.

The petition of February, 1871, reads as follows:

We the undersigned dentists take the liberty to ask most humbly of the high department of justice:

1. That an action be taken to the effect that nobody not having been graduated in medicine nor having passed the dental *tentamen* in this country may enter on dental practice, and that this prohibition come to the knowledge of the public.

2. That the requirements for the practice of dentistry be so modified as to guarantee the scientific training and the manual ability of the candidates which are essential for the welfare of their patients.

During the later years, more especially, it has become common practice for persons who have not graduated in medicine nor passed the dental *tentamen* to enter dental practice under the name dental technicians or dental artists. As things stand, everyone, even with the minimum of knowledge and technical skill, can establish himself in practice, as no authorization whatsoever is required for this purpose.

If these dental technicians had limited their activity to the manufacture and insertion of artificial dentures, the question would not have been of great importance, although inadequate and badly constructed dentures often may cause considerable inconvenience to the patient and even such serious consequences as ulcerations, and destruction of the natural teeth; but they do not rest satisfied with making dentures, and in most cases they are not even able to so limit their work. Every dentist knows that, in the great majority of cases, it is not possible to put artificial teeth in properly without previous operations, such as filing off, pinching off, boring the root or extracting the teeth.

These operations, if undertaken by persons lacking in all medical knowledge, as nearly all dental technicians and "dental artists" are, may sometimes be attended by dangerous consequences for the patient.

We therefore take the liberty to ask the high department of justice to authorize to practice dentistry only such persons as, through the authorization of competent judges, have been shown to possess the necessary knowledge and manual skill, and we also ask that dental practice by unauthorized persons be brought to the public's knowledge. Many dental technicians consider themselves entitled to practice, and the public, in general, has no clear idea of the difference between dental technicians and surgeon dentists, and therefore, in many cases, run the risk of being treated by ignorant persons.

At the same time, we beg to call the attention to the fact that barbers sometimes undertake extraction of teeth on a rather large scale, although few of them are authorized to do so or possess the necessary knowledge and ability.

As regards the dental *tentamen,* it is obvious that a reform is indispensable, if we take it for granted that the *tentamen* should guarantee the candidate's being in possession not only of the average preparation, but also of the necessary professional knowledge and technical ability. This is only partly the case with the dental *tentamen,* and it cannot be otherwise as long as anyone, although inferior in school knowledge and of average preparation can be admitted to the dental *tentamen,* and as long as the examiners, without

5. Hage indicates thirty in the first book of proceedings of the Danish Dentists' Association. We find the number thirty-three, and in the Scandinavian Dental Quarterly, 36.

disparagement of their medical ability, do not possess special dental knowledge, and as long as no training in technical skill is required for the dental *tentamen*.

We therefore take the liberty to make the following proposal concerning the dental *tentamen*:

1. That only persons who have passed at least the general preliminary examination or another of similar standard be allowed to take the dental *tentamen*.
2. That one among the examiners be a dentist.
3. That the candidate be examined as to his ability in manufacturing and inserting artificial dentures and on filling teeth.

Hoping that the high department of justice will take this application into consideration and awaiting a favorable reply, we beg to remain

Yours humbly.

June 16 of the same year, the department of justice sent the application to the Health Commission, who, July 8, 1871, gave their general endorsement. After a year's rest the department of justice again took up the matter in a communication addressed to the Health Committee, July 31: "Replying to the communication of Oct. 26, 1872, the Health Committee proposes an arrangement very similar to that proposed by the commission of 1865, with an additional requirement of examination on pharmacology. A copy of the Swedish regulations of examinations under date of Oct. 28, 1866, is enclosed, covering the arrangement of Swedish dentistry of June 18, 1861,[6] and rules against the introduction in Denmark of the Swedish requirement of a general preliminary examination of higher-standard as a condition for admission (the matriculation degree was not required in Sweden until 1879), and also against fixing a limit of age (in Sweden, the age of majority, 21 years.)" The communication explains its stand by the statement that it has become very usual that "Norwegians and Swedes and also quite a number of more or less reliable persons from Germany, granted that the present arrangement should be retained, will profit by the almost unlimited admission to the dental *tentamen*."

This fact was also complained of in Norway and Sweden. Persons who had not been able to pass the examination at home went to Copenhagen and were graduated there, whereupon they returned to their country and practiced without hindrance.

After correspondence between the minister of justice, the secretary of state for public instruction and the faculty of medicine, the secretary of state for public instruction, Feb. 13, 1873, sent in "a most humble memorandum aiming at the institution of a course for dentists under the auspices of the faculty of medicine." The petition was approved by the king, February 19, and March 1 and 3, a governmental decree was issued on dental training, the conditions of dental practice and its field of activity.

Aug. 30, 1881, the lower standard preliminary examination required as a preparatory examination by decree of March 1, 1873, was replaced by the so-called general preliminary examination.

In 1888, the dental school was founded, and in February, 1889, it was opened. It is still situated in the same place, and the course of study, three years, is the same as originally; but while the school began with two teachers and only the subjects absolutely necessary, both theoretical and practical,

6. In Norway, the dental law was introduced, Sept. 9, 1861.

except technic, the instruction has gradually become rather extensive and a staff of teachers, dentists and university professors, are employed, who, making the most of time and space, have succeeded in imparting to the young students a professional education that is not much inferior to the best known.

Until 1907, the instruction in prosthetic dentistry was given by practicing dentists in a two years' course (while the examination was passed at the dental school), but, in that year, the practicing dentists signed away their right to this training and transferred it to the Danish Dentists' Association, who founded the Danish Dentists' Association's Institue as a private institution, with two teachers, two assistants and two technicians. The institute was abolished in 1909, as dental technic in that year was introduced as a subject at the dental school. Later on, the dental school established another class for prosthetic dentistry and orthodontology, so that the technical training now requires three years.

As a supplement to dental education, it is now required that no dentist can obtain the right to practice unless he has worked two years as an assistant to a practicing dentist or in some public clinical hospital, as for instance, the dental school hospitals. Further, the Danish Dentists' Association holds postgraduate courses.

Feb. 25, 1916, there was passed the "Law on Dentistry," which established the position of the dentists, who, as we have seen, had had their only legislation in Clause 6 of the decree on empiricism of Sept. 5, 1794. .

It has never been possible to get action on the right of unauthorized persons to insert artificial teeth; neither have we succeeded in rendering the matriculation degree the obligatory condition for admission; but university students are now in the majority among the dental school students. Because of the very limited space at the dental school, only a restricted number can be admitted every year (about thirty-five), and there are always a considerable number of applicants; but, as the selection is made according to the grades made in the preliminary examination, only young people with the best records are admitted, a fact that in some respect remedies the defects of the rather inferior quality of the requirements for admission.

THE RADIOGRAM AS AN AID IN THE DIAGNOSIS AND PROGNOSIS OF PERIODONTAL LESIONS*

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THE roentgen ray, since its introduction into dental practice, has made clear so many of the dark places and has extended so widely the range of diagnosis that both the dental and the medical profession have almost unconsciously accorded it a position as an omniscient diagnostic aid. In considering this beneficent agency from the diagnostic standpoint, it therefore seems necessary at the outset to register the thought that it is *not* all-sufficient in this field. Within its limitations, it is a diagnostic aid of the greatest value, especially when these limitations are well understood. It will be the purpose of this paper, therefore, not merely to describe those periodontal lesions which register on the roentgen-ray negative, together with the skiagraphic variations which they produce, but to suggest such tests as may be of value in supplementing roentgen-ray findings.

As an introduction to this subject, it seems necessary to define and describe briefly the various types of lesion that are listed under the general heading of periodontal disease. The classification proposed by Harold Keith Box, which has proved to be the most acceptable, furnishes the simplest means of differentiation in relation to roentgen-ray diagnosis. He divides chronic periodontal diseases into two main groups: periodontitis simplex and periodontitis complex. The former is found in a minority of cases.

It comprises those cases in which the etiology is that of lack of function, and also those cases in which function is normal but in which irritants of the marginal gingiva make their appearance. In periodontitis complex, we invariably have hyperfunction or, as it has come to be generally known, traumatic occlusion, on which are superimposed gingival irritants and other pathogenic agencies, which need not be specified here. It might be well to add that these etiologic factors, outside the factor of function, have relatively little bearing on the roentgen-ray indications. This statement is inclusive of systemic factors as well as those that are localized definitely in the mouth; in other words, the roentgen ray may assist us in distinguishing between periodontitis simplex and periodontitis complex, but it gives no information regarding etiology, except such distinction regarding the degree of function as is implied in that general classification.

It is unnecessary to state to this audience that the roentgen ray reveals chiefly changes in the bone and dental structures. In studying the radiogram, we

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visualize soft tissue changes chiefly through our interpretation of the hard tissue changes that are revealed by this agency. Pericementitis, for instance, may frequently be diagnosed by means of the roentgen ray. But what we actually see in the radiographic negative is not an inflamed pericementum, but an extrusion of the tooth from its socket, or a resorption of the inner wall of the tooth socket. With this distinction in mind, we may proceed to a discussion of the changes that are revealed by the radiogram.

Fig. 1.—Full dental survey. Each film shows two teeth to advantage.

In periodontitis simplex, we have a disturbance that is localized largely in the region of the marginal and cemental gingivae and the alveolar crest. The roentgen ray will therefore reveal no pericemental disturbance in the early stages of this disorder. Such changes as are perceptible are confined to the region of the alveolar crest and consist radiographically of a diminished density of the bone at this point. This is followed by actual bone absorption, which proceeds at an even rate around the cervical region of several adjoining teeth. The margin of the alveolar crest does not, at any time, attain a sharply marked border, such as is frequently seen in moderately advanced cases of periodontitis complex. As the periodontitis simplex advances, there is greater evidence of pericementitis, indicated by an evenly distributed widening of the pericemental space through resorption of the inner surface of the lamina dura. This type of pericementitis is to be distinguished from a generalized pericementitis of pulpal origin by the fact that the pericementum is thickest at the location of the alveolar crest, and diminishes evenly to a more nearly normal size as it approaches the apex. The prognosis of periodontitis simplex is favorable as long as there is radiographic indication that sufficient alveolar bone remains to provide support for the performance of at least a modified function, and as long as there is no indication of pulp infection.

Fig. 2.—A distinction between normal and excessive occlusal stress. The first bicuspid exhibits resorption of the alveolar crest, without deeper pericemental disturbance. The second bicuspid exhibits crest resorption and pericemental disturbance (rarefying pericementitis fibrosa) on the mesial side near the alveolar crest.

Pulp infection, whether in the simplex or complex type, may be indicated in one of two ways. The first, and more common, is a widening of the pericemental space at the apex, leading to

Fig. 3.—Entire absence of occlusion; marked resorption of the alveolar crest with but little deeper pericemental disturbance.

periapical alveolar rarefaction. The other is a condensation of the periapical bone, especially when confined to the periapical region. This latter is readily overlooked, especially when slight in degree, but should always receive serious consideration when present in perceptible amount.

In periodontitis complex, we have,

Fig. 4.—Entire absence of occlusion; more advanced resorption of the alveolar crest, and generalized pericemental disturbance.

as stated before, a disturbance whose etiology has, as its chief factor, traumatic occlusion. This factor, in conjunction with various other injurious agencies, produces several typical disturbances of the dental and periodontal structures. In a considerable percentage of cases in which there is a combined

Fig. 5.—Traumatic occlusion; resorption of the alveolar crest, with marked but localized pericemental disturbance.

high resistance to gingival infection and sturdy alveolar support, the disturbance, which is essentially a disturbance of the pericementum, localizes itself at the apex and produces changes in the pulp circulation. In the early stages, this will be susceptible of diagnosis as pulp hyperemia. In this stage, the radio-

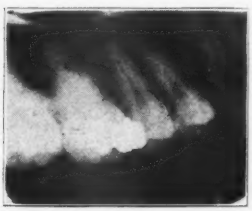

Fig. 6.—Slight rarefaction at the apex of the first bicuspid, outlined by a light line at the end of the root.

gram is of value only as a means of eliminating other causes of pulp disturbance. It shows, usually, no alteration of the alveolar bone. If the

disturbance is long continued, the periapical bone becomes involved, and this will register on the radiographic film as an area of rarefaction. This rarefaction, because of its similarity to the rarefaction produced by a granuloma, frequently leads to a diagnosis of pulp death, with the ensuing classic periapical changes. Pulp death may actually supervene in these cases, but the diagnosis must be made by other means, such as pulp vitality tests, in conjunction with the radiogram. Usually, the rarefaction is of slight degree, and it is often bounded by a faint but distinguishable line of demarcation. This line, in the average case, instead of describing a curve as does the line bounding a granuloma, assumes the conformation of the end of the root, describing a fairly distinct point, similar to the outline of the root end, and located directly in line with the root. In some cases, the similarity of this line to the appearance of the root end is so striking as to cause some uncertainty as to whether or not it is actually the root apex.

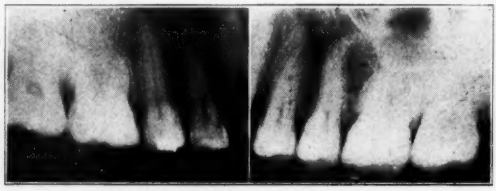

Fig. 7.—Upper first molars from opposite sides of the same mouth. The conditions are normal around the right first molar. The occlusion is also normal. There is a pericemental disturbance (rarefving pericemental fibrosa) on the mesiobuccal root, left first molar, due to traumatic occlusion.

In another type of case, we find the alveolar support so nearly in equilibrium with the overload that retrogressive changes are not induced, at least not during the earlier years of life. In

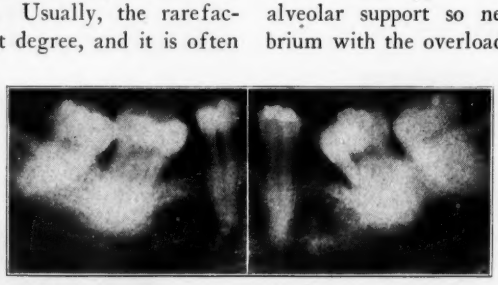

Fig. 8.—Lower second molars from opposite sides of the same mouth, both subject to traumatic occlusion. The right second molar exhibits bone condensation, probably physiologic, along the mesial side of the root. This has been followed by pocket information, indicated by the dark wedge encroaching on the alveolar crest on this side. The left second molar exhibits a similar condition, with beginning of bone condensation around the apex. This is usually indicative of pulp infection.

these cases, we find evidence that traumatic occlusion may have a stimulating effect, since it leads to a building up of alveolar bone. This will be recorded in the radiogram as a condensation,

Fig. 9.—Condition of the second bicuspid similar to that shown in Figure 6. The tooth gave symptoms of marked pulpitis. This disturbance was first attributed to caries, and was treated without success by sedative temporary fillings. The tooth was later made comfortable by relieving the traumatic occlusion which is indicated by the alveolar crest resorption. The pulp was vital and comfortable one year later.

which is localized largely in the lamina dura along the side of the root. Such condensation, needless to say, is not to be considered pathologic, but it may be followed by other changes, to be described, which are retrogressive in character. It thus may happen that the radiogram will reveal an intermingling of progressive and retrogressive changes.

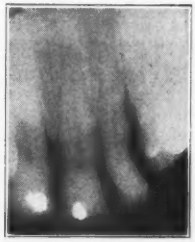

Fig. 11.—Traumatic occlusion inducing alveolar crest resorption and periapical rarefaction of a diffuse type. The pulp is vital and apparently healthy.

In such cases, the sequence of the events whose record is found in the radiogram, must be kept in mind in making the diagnosis. In other words, when we see such intermingling of types of tissue changes, we must give the greatest weight to the evidence of retrogression.

Fig. 10.—Marked rarefaction at the apex of the second bicuspid; pulp vital and without subjective symptoms of pulpitis. There is advanced pulp infection possibly due to previous deep caries. Evidence of traumatic occlusion is lacking, except as this will be inferred from lack of balance due to extraction of other teeth.

Fig. 12.—Condition similar to that shown in Figure 11, but exhibiting more pronounced rarefaction around the apices. The prognosis is uncertain.

In the great majority of cases exhibiting traumatic occlusion, retrograde

changes are the only ones perceptible in the radiogram. These changes are the accompaniment of certain well-defined steps in periodontitis complex, for whose delimitation we may again refer to Box.

Fig. 13.—Traumatic occlusion on the left central incisor without appreciable alveolar crest resorption; marked periapical rarefaction, with nonvital pulp. Periapical disturbance caused by traumatic occlusion is invariably more severe if the alveolar structure does not give way and permit mobility of the tooth.

The earliest sign of disturbance is to be found in the pericementum. This Box calls rarefying pericementitis fibrosa. As its name implies, it is a lesion

Fig. 14.—Condition similar to that shown in Figure 13, except that rarefaction at the apex of the cuspid is more faint. The pulp was vital when the radiogram was taken but lost its vitality one month later.

of the pericementum which produces rarefaction of the adjacent alveolar bone. This is evidenced in the radiogram by a widening of the pericemental space.

A differential diagnosis between rarefying pericementitis fibrosa and the types of pericementitis described earlier

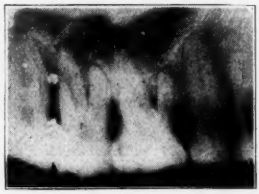

Fig. 15.—Traumatic occlusion with alveolar crest resorption. The pockets do not reach to the apices of the roots. There is marked rarefaction around the apices. The pulp is vital. Pulp death and acute abscess followed two months after radiogram was taken.

in this paper may be made chiefly on the distribution of this pericemental thickening. In rarefying pericementitis fibrosa, the thickening of the pericementum is frequently to be observed preceding

Fig. 16.—Advanced alveolar absorption and pocket formation on first bicuspid. The tooth is mobile, the pulp vital. The periapical bone shows only the slightest disturbance. There is a distinct outline of the lingual border of the alveolar process. When so much bone has been lost around a posterior tooth, the prognosis is usually negative.

absorption of the alveolar crest. It is usually found at the alveolar crest. The chief characteristic is that the thickening of the pericementum is not uniform. Frequently, the pericementum on one

Fig. 17.—Advanced alveolar absorption and pocket formation, the penetration of which toward the apex is shown by the guttapercha cone placed temporarily in the pocket. The dark wedges indicate bone absorption on the approximal sides of the teeth. The prognosis is positive, owing to distribution of the alveolar support.

side of the tooth is not affected to a perceptible extent. Again, the pericementum near the alveolar crest may appear to be normal, and thickening

Fig. 18.—Advanced alveolar resorption and pocket formation. The pulp is vital; the periapical condition, good. The prognosis is unfavorable unless it is supported for a long time or perhaps permanently by a splint.

may be observed at the other points, including the apical region. The pericementum also frequently shows alternate thick and thin areas. The distinction lies in the variation of thick and thin and the uneven distribution of the thick area.

Another stage in periodontal disease, according to Box, is cemental gingivitis, or inflammation of the cemental gingiva. In this stage, infection, which is not necessarily associated with rarefying pericementitis fibrosa, becomes a definite part of the picture. Pocket formation now begins, but is preceded by absorption of the alveolar crest. This is in-

Fig. 19.—Alveolar resorption involving the distal root of the first molar and extending 2 mm. beyond it. The mesial apex exhibits marked pericemental disturbance. The prognosis is negative.

dicated by radiolucency of the bone in this region. At this stage of periodontal disease, there may be confusion as to whether the type of disease which is in progress is periodontitis simplex or periodontitis complex. In the simplex type, as stated before, there is no sharp definition of the resorbing alveolar border. In the complex type of which we are now speaking, the alveolar bone, especially on the lingual side, frequently exhibits a sharp border.

When this is seen, a diagnosis of periodontitis complex may safely be made.

As the cemental gingivitis progresses, alveolar resorption continues, and the pocket encroaches on the pericementum. If this process is taking place on the approximal side of the tooth, the radiographic indication lies in the formation of a dark wedge-shaped area whose base is toward the gingival tissue and whose apex is toward the root end. This area is typical, and its significance is well understood. When this process is confined to the labial or buccal aspect of the tooth, the radiographic indications are much fainter and may frequently be imperceptible. Herein lies the most important limitation of the radiogram as a diagnostic aid in this type of periodontal disease.

Fig. 20.—Alveolar crest resorption on the second molar, which has probably followed an earlier bone condensation. The bone condensation involves the apices, indicating pulp infection. The prognosis is negative.

As disease progresses, the periapical tissues gradually come within range of the infective process, which Box at this stage designates as infective periodontitis. This is indicated in the radiogram in several ways. First, there is a widening of the pericemental space around the apex. This may appear at an earlier stage, as indicated under the discussion of rarefying pericementitis fibrosa. When found in conjunction with the advancing wedge-shaped area, it indicates an advanced periodontitis. Another indication of this stage is rarefaction of the bone opposite the apex of the advancing wedge, or rarefaction of the bone around the apex of the tooth.

When the periapical region of the tooth becomes involved in any of the modes just described, it becomes necessary to determine the state of health of the dental pulp. The indications so far stated do not in themselves connote a definite indication of pulp infection; that is to say, in their earlier manifestations. When the pulp becomes infected to a pronounced degree, this is indicated by a periapical rarefaction extending 2 mm. or more beyond the root end. When so extensive a rarefaction is observed in this region, the prognosis becomes negative. Periapical rarefaction indicative of pulp involvement may, in some cases, make its appearance without

Fig. 21.—Marked periapical rarefaction around the lingual apex of the first molar. There is marked and uniform thickening of the pericementum around the mesiobuccal root. When pericemental disturbances result in this marked and uniform thickening, the indication is of advanced pulp infection. The first molar here shown was in the early stage of acute abscess formation when the radiogram was taken.

the accompanying wedge. If the pocket advances along the labial or buccal surface of the root, there may be little indication in the radiogram of its presence, until the periapical rarefaction gives notice of the advanced state of the disease. It should therefore be obvious that the local examination by means of a probe is an essential adjunct to the roentgen ray in all cases of periodontal disease.

It has been indicated, at least indirectly, that the prognosis of periodontal disease is positive as long as indications of pulp infection are absent.

Fig. 22.—Marked rarefaction on the mesial side of the cuspid involving the apex and extending beyond it more than 3 mm. There is also resorption of the root end. The prognosis is negative.

The opposite is also to be accepted, viz., that the prognosis, in cases having demonstrable pulp infection, is negative. In the case of pulpless teeth having deep pockets and bone rarefaction involving the root end, the same negative prognosis is established. In the absence of such periapical rarefaction and with less deep pockets, very satisfactory response to treatment may frequently be obtained.

Another aspect of the question of prognosis has to do with the amount of alveolar bone which remains in immediate contiguity with the tooth. In the average case, a tooth possessing half of its original alveolar support may be said to have a positive prognosis. The situation is more favorable if this bone extends well toward the tooth cervix on at least one side of the root. This information is, of course, readily obtainable from the radiogram.

As a collateral aid in diagnosis, it will be well to mention the deformity of incisal and occlusal surfaces which frequently occurs as the result of wear brought about by traumatic occlusion. This will frequently register on the

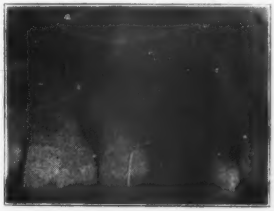

Fig. 23.—Marked pericemental thickening on the lateral incisor, not involving the apex. The cuspid exhibits advanced alveolar resorption, involving the apex. The diverse types of hypercementosis may be noted. The prognosis for the cuspid is negative; for the lateral, uncertain, with probability of future pulp disease.

film as an altered silhouette of the affected teeth. This deformity, to which Pollia has called attention, is characteristic and indicative of traumatic occlusion, and may thereby serve to confirm a diagnosis of periodontitis complex.

In the course of prolonged periodontal disease, the irritation set up in the pericementum leads to an activity of the cellular elements of this tissue,

which results in the absorption of cementum. The resorbed areas may be so slight as to be perceptible only by the aid of the microscope. These areas do not register in the film and, when so minute, seem to have relatively little clinical significance. When this absorption is so extensive as to register on the radiographic film, the prognosis of the case is usually negative. This negative prognosis is confirmed if a pocket extends near the area of absorption.

Other radiographic indications of periodontal disease are not infrequently to be seen. Their comparative rarity and the brevity of this paper preclude describing them at this time. The radiographic indications which have been described comprise those most commonly found, and familiarity with them and with their significance will provide at least a working foundation for study of the dental radiogram in the diagnosis of periodontal disease.

A CONSIDERATION OF SO-CALLED PERIODONTAL NOMENCLATURE*

By L. PIERCE ANTHONY, D.D.S., F.A.C.D., Philadelphia, Pennsylvania

THE specialty of periodontia, so-called, is of comparatively recent origin as such. Those who devoted themselves to the phase of dentistry now designated by the term "periodontia" previous to the time when it assumed the dignity of a specialty called themselves specialists in the treatment of pyorrhea. Practical experience had taught these practitioners that the periodontal membrane of the teeth was the tissue or membrane more vitally concerned in the condition of pyorrhea than any other, and truly so from their point of view, and I may venture to add that this is still true from the present point of view.

When this group of men, imbued with the importance of this membrane in relation to their work, launched out as specialists in the practice of dentistry about a decade ago, it was but a natural expression of their enthusiasm to wish to imply in the name which the specialty adopted some association with this membrane; hence, we have the term "periodontia," intended to designate that branch of dentistry concerned in the prevention and treatment of diseases of the tissues around the teeth.

If the specialty had made no progress beyond this original conception of its pioneers, the term would still correctly express the scope of the activities of the so-called periodontist; but it has progressed marvelously in the past decade. You have by clinical observation and scientific study learned and proved to the profession not only that pyorrhea is the result of abnormal conditions of the periodontal membrane, but also that all the investing tissues of the teeth are equally involved and that occlusion is definitely related to the health and disease of these tissues. So important and

*Read before the Section on Periodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

far-reaching has this relationship proved, that the specialty has become firmly established in a most important and vital relationship to all branches of dentistry and even to medicine. And yet the specialty stands still, as it were, in its nomenclatural development in retaining a name that specifically designates it as related practically to only one of the investing tissues of the teeth—the periodontal membrane.

With the feeling that the nomenclature restrictions that this group have unwittingly imposed on themselves must necessarily inhibit free and unhampered development, I come today with a suggestion, which I believe, if followed, will loosen the etymologic shackles which bind the specialty and will enable the members to broaden the scope of the nomenclature in keeping with the broadening scope of their activities as specialists of the great healing art.

The burden of my effort, then, shall be to endeavor to prove that the term "periodontia" is too restricted in its meaning to encompass the field now occupied and is etymologically incorrect as designating the scope of the specialty. My arguments shall be based not only upon the present day conception of so-called periodontia, but also upon the etymology of the word as accepted and used today in technical and academic language.

Periodontia is derived from the Greek prefix *peri*, which means "around" in the sense of immediately surrounding or encircling, and *odous*, tooth, with the suffix "ia," which, in medical nomenclature, has come to mean the science and knowledge relating to a specialty. Both in medical and dental literature, the prefix *peri* has been so used for decades, and hence we have the term periodontal membrane, which means the tissue or membrane immediately surrounding or encircling the root of the tooth. This membrane has also been designated by the terms "peridental membrane," "pericementum," "peridentium," "periodontium" and probably others that I do not recall at the moment.

It can be seen, then, that in its strict etymologic meaning "periodontia" can mean no more than the science and knowledge pertaining to the periodontal membrane, a limitation which, I am sure, none of you wishes to place on his activities.

The Greek prefix *para*, means "about, near, in the neighborhood of, next to," etc., and is thus used in dental and medical literature to distinguish tissues that have more than a strictly encircling or surrounding relation. My suggestion, then, based on a serious study of the derivative words, is that the specialty would be more properly designated by the term "parodontia," which means the science and knowledge of the tissues and conditions about, near, next to and in the neighborhood of the tooth, which is what I am sure you wish to imply as constituting your field of activity.

The adoption of the use of the prefix *peri* in a broader sense than it can be applied has restricted the scope of the nomenclature and has given rise to numerous associated terms that are necessarily faulty and confusing from the etymologic standpoint, such as periodontoclasia, dental periclasia and periodontium, which are quite confusing, as they are used in a broader sense than etymologic license allows.

A few concrete examples of the confusion that exists at present in the use

of these terms in the specialty and in dentistry and other sciences will suffice:

You use the term "periodontium" to designate the investing tissues of the teeth—the gingivae, the periodontal membrane and the alveolar process about the root; whereas, this term is understood by histologists, anatomists and the dental profession at large to mean the pericementum or the periodontal membrane and nothing more. You use the term "periodontitis" to mean inflammation of all the investing tissues, whereas peridentitis, its synonymous word, has long been in use to mean inflammation of the peridental membrane.

The adoption of the two prefixes *peri* and *para* as suggested and as used in other sciences would not eliminate the terms now used, but would give them their correct meaning and would allow distinctions of meaning that are not now possible. For example, periodontitis or peridentitis would mean inflammation of the periodontal or peridental membrane; and parodontitis or paradentitis would mean inflammation of the investing tissues of the teeth.

The adjective "periodontal," as you now use it, relates to either the periodontal membrane or the investing tissues of the tooth as a whole; whereas, the adoption of the adjective "parodontal" or "paradental" would enable you to distinguish the two conditions above indicated.

Then, too, the word "paradental" is already in use and understood to mean what I have above indicated; so also are paradentitis, peridental, peridentitis, paradentium, periodontium, etc.

Malassez, dental histologist, many decades ago used the term "paradental" as I have used it. He also used the term *paradentaires*, which is the French term corresponding to "paradentium," to designate the investing tissues of the teeth. Weski, the German histologist and pyorrhea researcher, also uses the terms "paradentium," "paradentosis" and "paradental" in the senses that I have indicated.

In support of my contention, I offer as corollaries and analogous examples, in use in anatomic and medical nomenclature, a few well-known examples: periosteum, (*peri*, around + *os*, bone) periangitis, periblast, pericapsular, pericardium, pericarditis, pericarp, pericementum, perichondrium, pericorneal, perimetrium, peritoneum, etc., indicating the accepted use of the prefix *peri;* and paracentral (situated near a center), paradental (near a tooth,), paragraph (written beside a line in the margin), paralysis, paraneural, parathyroid, parotid, (*para*, near + *ous*, ear), etc., indicating the accepted use of the prefix *para.*

The suggestion has been offered that periodontia and its associated terms have been so long in use that it will be difficult to change now; to which I submit that it was the wrong form in the beginning, and as we have attempted to extend the nomenclature, the error has been magnified. The error is therefore more apparent now and it is therefore more necessary that it be corrected as soon as possible.

At the request of the chairman of the section, I would offer the following comment on the term "traumatic occlusion." This term has been much criticized, and rightly may be interpreted to mean occlusion caused by an injury. While this is true, those who criticize it overlook the license allowed in the English language for the use of the adjective. There are numerous

analogies that would warrant its meaning to be injury caused by occlusion. I would suggest that occlusal trauma is a better term and obviates the possibility of confusion present in the term "traumatic occlusion."

The nomenclature of any specialty or profession is certainly a reflection of its intellectual status, and in proportion as its nomenclature is faulty will it meet difficulty in attempting to transmit its knowledge to its own members, and increasingly so to the other biologic sciences. It is apparent, I believe, that the nomenclature of any profession or specialty should conform to that of the other biologic sciences, if that specialty hopes to develop to an intellectual status that will warrant its being classed with the other sciences.

It is quite possible that, in my endeavor to present my contention logically and convincingly, I have unduly emphasized some phases and probably unnecessarily repeated others. I trust that this expression of enthusiasm will not detract from the force of my argument or in any way reflect on my sincerity in presenting it for what I believe to be the benefit of the specialty as well as for the benefit of dentistry as a whole.

In closing, may I say that I am quite conscious of the immutable law of language that, no matter how many revisions of terminology are made and no matter who makes them, we can be sure that, in the end, only those terms will survive which are wisely selected, which are precise in expression and which are vitally and logically related to the great general plan to which our dental nomenclature will ultimately conform.

The terminology of a profession or a specialty must rely on its intrinsic merits, and the better it satisfies and serves the purposes and needs of teaching and investigation, the greater will be its chances of acceptance and permanence. Those of us who are convinced of the value of the terms offered should set the example by using them and recommending their use to others.

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DISCUSSION

R. Ottolengui, New York City: My association with Dr. Anthony on the Committee on Nomenclature taught me not only that he is a sound etymologist, but also that he is a purist. Now, I am rather inclined to be a purist, and to resent poorly constructed terms, and the coining of unnecessary new words. At the same time, I have come to believe that purity, in language, as in morals, can be carried to the extreme. Our words should be as pure as possible, but they should also be practical. After recommending a change in the word "periodontia" to make it read "parodontia," Dr. Anthony refers to the contention that it is too late to make a change in this term, and contests this with the argument that "It was wrong in the beginning, and as we have attempted to extend the nomenclature, the error has been magnified. The error therefore is more apparent now, and it is therefore more necessary that it be corrected as soon as possible." This argument does not appeal to me as entirely sound, for reasons that I shall give. But first let me say that Dr. Anthony is entirely consistent. He has apparently long held this idea that words must be made etymologically correct, even though words long in use must be discontinued. The trouble is that words long in use cannot be readily discontinued. A member of the editorial staff of the Standard Dictionary long ago explained to me that once a word appears frequently in the language, the lexicographer must include it in his dictionary, because the main purpose of a dictionary is to enable a reader to understand printed words. The dictionary also must enable the reader to understand not only current literature, but likewise literature of the immediate past, and even of the distant past. As the use of a word ceases to be con-

stant, the dictionary declares it first to be obsolescent, and later marks it as obsolete. Thus, it takes many years actually to obliterate a word once in common usage. And for this reason we should be just as careful not to substitute a new word, however correct it may be etymologically, as we should be at the outset to coin correctly the word that we wish to introduce. As a fitting example of what I mean, the first report of the American Dental Association Committee on Nomenclature recommended that "radiogram" be used in place of "radiograph." This is an old bone of contention between Dr. Anthony and me, but I trust that he will pardon my using it as an example to prove the undesirability of displacing words in common usage. At that time the word "radiograph" was in almost universal use in dental literature, and was quite readily comprehended in spite of its doubtful correctness from a purely etymologic point of view. At least, in spite of its possible impurity, it had this practical advantage: radiograph meant, and still means, a photographic picture made with the aid of the roentgen ray, and it means nothing else. Can this be said of the word radiogram? As I write this, news has come of the success of Gertrude Ederle in swimming the British Channel, and the newspaper states that radiograms gave them constant knowledge of her progress. We now have two words meaning the same thing, and the newer word meaning two things. A change of terms should be made regardless of the difficulty whenever there is vital need of such a change. Dr. Anthony thinks that there is. Let us then consider this from his point of view. He says: "Periodontia can mean no more than the science and knowledge pertaining to the periodontal membrane, etc." What more should it mean? Let me ask the periodontists present this question: If you find the periodontal membrane in a state of health, would you consider that any disease of the environmental tissues that might be present rightfully came within the field of what you term periodontia? I think not. Dr. Anthony further says: "The specialty would be more properly designated by the term 'parodontia,' which means the science and knowledge of tissues and conditions about, near, next to and in the neighborhood of the tooth; which is what I am sure that you wish to imply as constituting your field of activity." Now I am equally sure that the present-day periodontists do not so define their field at all. That knowledge of normal and of diseased conditions of parodontal tissues is vital to correct treatment of periodontoclasia none may deny, but there are many such diseases the treatment of which are entirely outside the limitations of this specialty. Of course, some of these may come within the purview of the periodontist, and he may even treat and cure them, but his right to do this is based on the fact that primarily he is a dental surgeon, rather than that he is a periodontist. For example, not infrequently, during orthodontic treatment, a molar band may become uncemented, and food passing between the band and the tooth surface is forced into the gingival crevice, and infection ensues. I have seen the "parodontal" tissues so swollen and so full of pus that a true abscess had formed, which, in the past, I have called an "interproximal" abscess. In such cases, if seen early, as they usually are, the periodontal tissue is in a state of undisturbed health. Shall the orthodontist send this patient to a periodontist, or shall he remove the band, wash out the infected area, and see it cured in a day or two? It is not truly within the scope of a discussion of terminology to go too deeply into pathology, but as the specialty at present is understood, do such lesions as carcinoma, epithelioma, cysts both dermoid and radicular, odontoma, adamantinoma, osteomyelitis, alveolar necrosis, etc., logically fall within the scope of the periodontist? Yet they are all diseases of the "parodontal" tissues. Dr. Anthony thinks that the term periodontia too greatly limits the field of this specialty. Yet it seems to me that the alternative word which he suggests, parodontia, too greatly expands the field. But even if it were a better word practically and etymologically, I think I must agree with those who contend that at this late day it is inadvisable to attempt the change, thus giving us two words where one has served so well. The word parodontia is not so pure etymologically as one might at first deem it. As analogies to "parodontia," Dr. Anthony quotes a number of words, and apparently whenever the word is purely of Greek origin, we have the spelling "para." thus: paragraph, paralysis, paraneural, etc. The exception is "parotid," which may possibly be as bastard in construction as "parodontia," in which the prefix reads "par" instead of "para." In periodontia we have

at least the prefix in its pure Greek form. I quite understand that I may be entirely wrong in this, and that it may be perfectly permissible to thus abbreviate the "para" into "par" because of the letter "o" following. Nevertheless, it seems worth while to call Dr. Anthony's attention to this. As regard to "occlusal trauma," and "traumatic occlusion," again it seems to me that the suggestion of Dr. Anthony is inadvisable. Dr. Anthony admits that the English usage of adjectives permits the meaning which "traumatic occlusion" is intended to convey. Yet he contends that the term "rightly may be interpreted to mean occlusion caused by trauma." While it is true that when the periodontist speaks of traumatic occlusion, he means such an occlusion as will cause traumatic injury to the periodontal tissues, nevertheless is not traumatic occlusion most frequently the result of trauma? Does it not follow extraction of adjacent teeth, which permit elongation? Does not attrition by shortening the cusps of certain teeth cause adjacent members to be in traumatic occlusion? Indeed, is not traumatic occlusion practically always a vicious circle which causes and is at the same time caused by trauma? However that may be, Dr. Anthony has admitted that the intended meaning may be carried by the words as they are now used. Personally, I am opposed to the transposition, because such alteration of sequence places emphasis on the wrong word. If we speak of occlusal trauma, we think mainly of trauma, because that is the noun. But if we speak of traumatic occlusion, we think of occlusion, and that is exactly what we should be thinking of when we come to treat the case. It seems to me that "occlusal trauma" places the cart before the horse, and it is the horse that we must drive. If we do that the cart will follow. If we correct the occlusion, we will correct the trauma.

John Oppie McCall, New York City: Dr. Anthony has raised essentially two points regarding the nomenclature which has been developed to provide means for the expression of newer knowledge regarding diseases of the supporting structures of the teeth. The first of these is regarding the term "periodontium" and its derivatives: the second has to do with the term "traumatic occlusion." He takes exception to the former, and would, by implication at least, have us substitute for it *paradentium* or "parodontium." Without reference to the merits of the case, it may be noted that this change is proposed at a rather late date. The word "periodontium" has appeared in medical dictionaries for many years, somewhat loosely defined as "the tissue around a tooth." There is no word "paradentium," although the word "paradental" appears, defined as "near a tooth." (Dorland.) The definition of "paradental," on the face of it, refers less clearly to the investing tissues of the teeth than does the term "periodontal," an adjective derived from "periodontium." Leaving this distinction for a moment, it is interesting to note that the terms "periodontium," "periodontia," etc., were adopted with their broadened meanings, to which Dr. Anthony objects, by the American Academy of Periodontology at the outset of its career, twelve years ago. These terms immediately began to find their way into dental literature but aroused no protest until within the past two years, and this in spite of the use of "paradental," etc., to which Dr. Anthony refers. Incredible as it may seem, these terms were ignored, I must assume, by those who professed a scientific insight into the nature of periodontal disease, until it was found that the users of these terms were not only teaching the dental profession how to treat successfully the disease which they called pyorrhea, but were also demonstrating an understanding of its pathology. If this is not the case, I shall be most happy to be informed of my error. That I may not seem unduly captious in this matter, I will cite an instance in point. At the time that the newer periodontia began to attain some prominence, a practitioner who had achieved some success in periodontic practice was called to the faculty of a dental school, and assigned to the treatment of such cases of periodontal disease as appeared in the college clinic. He achieved sufficient success to arouse the interest of other faculty members. But when his request that he be allowed to lecture to the students on the subject was referred to the professor of dental pathology, it was refused, with the statement that the periodontist in question knew nothing about pyorrhea. Regarding the respective merits of the two terms under discussion, the important point is seen to be in the choice of the prefix. In this connection, I shall quote Prof. R. V. D. Magoffin, head of the department of classics of New York University: "The prefix *para* means 'by the side of,' 'beside,' 'alongside of.'" This

prefix is in good use in about eighty-five scientific terms in anatomy, natural history and pathology. In anatomy and natural history, it is used relative to an organ or part situated beside or near or standing in some subsidiary relation to the second element. In pathology, it denotes diseases affecting such parts. Most of the eighty-five usages are pathologic and, in composition, the usage seems to be prevailing of a meaning that runs into faulty, disordered, perverted, simulated, etc. *Peri*, in composition, means "round," "around," "roundabout," "about." In composition, as an adjective, there are about seventy-five words in good scientific anatomic and pathologic use meaning "surrounding," "enclosing or pertaining to." I might mention among them: periarticular, pericerebral and perigastric. There are about sixty nouns in good scientific usage in composition with *peri*. The words denote a part or organ surrounding or enclosing that of the second element. A number of these words are pathologic terms, and all the words in that group have to do with diseases connected with "connective tissue." Pericolitis would probably come first to mind. As a good comparison, I might mention two words: "paradenitis," meaning inflammation around a gland, and "periadenitis," which means inflammation of the connective tissue around a gland. In my judgment, both adjectives and nouns compounded with *para* fail to describe tissues or diseases which surround the element. *Para* can mean anything near or in the neighborhood of. *Peri* means that also, but has the additional meaning of something that surrounds; nor does it need to mean a connecting envelop or tissue. Its meaning can extend further than the first enveloping tissue. This opinion needs no comment. Nevertheless, it might be pertinent to call attention to certain other points which have a bearing on the case. For instance, the term "periodontal membrane," even if used in the sense proposed by Dr. Anthony, must, of necessity, refer to the entire fibrous structure immediately enveloping the tooth root. If this is so, it will include the gingiva, which is an integral part of this fibrous structure where it emerges above the level of the alveolar crest, the tissue at this point being made up largely of the transeptal and gingival crest group of fibers. The inclusion of the gingiva and alveolar bone with the pericementum in a composite of investing tissues having closely associated functions, and bearing a collective name, seems entirely logical. The pericementum itself of necessity includes fibers which are inserted into the alveolar bone, binding this latter structure histologically, as well as functionally, to the pericementum. In fact, there can be no pericementum without alveolar bone. If we study the problem from the standpoint of function as already suggested, we find it impossible to dissociate these three structures. And when we study the diseases which attack them, we find dissociation equally impossible. Let us agree with Dr. Anthony that the term "periodontium" originally carried a significance more restricted than that which we now propose to assign to it. Even so, medical nomenclature furnishes a precedent for amplifying or qualifying the original definition in a term whose original meaning has become so extended as to represent a far more glaring abuse of etymologic usage than that of which he accuses the periodontist. I refer to the term *epulis*, which is defined as "a fibrous tumor of the gums." This word is applicable to such varied growths that it must, whenever used, be immediately and definitely qualified as to the type of tumor under discussion. The term "periodontium," if allowed by Dr. Anthony and other conscientious objectors to continue in the place it already occupies in dental literature, will need no such reiterated qualification. I will also remind Dr. Anthony that the usage of a word determines its authority. Usage of the term "periodontium" and its derivatives, already well established, may, therefore, be depended on to entrench these words in our literature. In spite of a usage extending over the past twelve years, however, I should join Dr. Anthony in advocating a change were I convinced of the etymologic superiority of the term that he proposes. Being unconvinced by his arguments, I shall continue to advocate the term "periodontium," in designating the collective investing tissues of the tooth. With reference to the terms "traumatic occlusion," and "occlusal trauma," let me say that each has a definite meaning and each has a use which is proper. The terms are not synonyms, although sometimes used synonymously through careless writing. The term "traumatic occlusion" was once attacked by an eminent dental author, who, for reasons best known to him-

self, failed to name the authors or the book to whose pages he so definitely referred. Following his example, I shall mention no names when I call attention to the fact that this writer has more recently acknowledged the pathogenic possibilities of what we call "traumatic occlusion," under the guise of the inverted phrase "occlusal trauma." Traumatic occlusion is a condition of the occlusion, as will be appreciated from the use of the noun, which may and usually does cause injury. Traumatic occlusion is not the injury itself. Occlusal trauma, however, is an injury, in this case an injury due to some condition of the occlusion. Traumatic occlusion is the cause; occlusal trauma is the result. It will thus be seen that the terms cannot be used interchangeably, and also that the term to be used must be selected according to the meaning which the writer intends to convey. In conclusion, let me state that while I cannot agree with Dr. Anthony's contentions, I do commend his earnestness and enthusiasm as a purist.

F. V. Simonton, San Francisco, Calif.: It is essential for scientific purposes and in formal discussions that we employ a specific, accurate and univocal term to designate retrograde changes of the investing tissues of the teeth. The term "periodontoclasia" is entirely too narrow to indicate the scope which it is intended to comprise. "Parodontoclasia" is accurate and possesses the advantage of being slightly shorter and somewhat more easily enunciated. The adoption of this term will, of course, necessitate the collaterals: parodontia, parodontitis, parodontosis, etc. The use of the prefix *para* will also liberate that of *peri* to its proper employment. Any confusion that might arise from the similarity in sound can be overcome by stressing the last vowel. This we do in chemical nomenclature when we stress, for example, compounds ending in "ous" and "ic."

Alex Krikos, Athens, Greece: Being isolated from any center of scientific dental activity during the last seven years, I am extremely pleased to have heard this scholarly paper of Dr. Anthony and the discussions. But, while in this isolation, I have had to work out my own salvation on each and every subject that may confront the general practitioner, and this possibly may be the reason why I disagree with Dr. Anthony on this subject. The terms "pyorrhea," "periodontoclasia," "periodontia" when expressed to a Greek, in the Greek language, do not mean anything without further amplification. Neither do I believe that they mean anything here without a further explanation to the patient, because in that single word "periodontoclasia," that we wish to employ, we must include the meaning of soft and hard tissues plus the ending of the word in "itis" to give us the inflammatory conditions of those tissues. This being the case, I found it necessary in my practice to employ the term "gingivitis" "ulitis" or "ouditis" in the Greek, to that adding an adjective if necessary to express the progressive stage of the disease, i. e., suppurative gingivitis, etc. This term conveys the idea clearly to the Greek. I am of the opinion that no matter how much we may try to modernize our terminology, in time we may find it necessary to resort to the old term "gingivitis" (ulitis, ouditis), adding an adjective if necessary to express the various stages of the disease. I do not wish to hinder your effort, but I think that in the word "paradontium" the prefix *para* is replaced by *peri*, the idea may be conveyed better. Also, there might be found in the Greek terminology other terms which I may give off-hand that may convey the idea even better, for example, "peri-rizitis," riza standing for root; or ulopharnitis, a word that may give a fuller conception of the condition as "oudos" stands for gum; pharnion alveolar process.

CASTING SUBSEQUENT TO INVESTING*

By W. D. N. MOORE, L.D.S., D.D.S., Chicago, Illinois

AFTER the wax pattern has been invested, the time required for the investment to set sufficiently to permit of "burning out" is dependent on certain considerations, the principal one of which is its make. Whether or not it is true of all investments, certain makes of these have within them a retarding agent to facilitate manipulation. Aware of the fact there are slow workers as well as fast workers among dentists, the makers of our standard grades of investment were not unmindful that the slow operator had to be provided for, but it could not be expected that any two makes would be alike in this respect. So, to speak with any accuracy of the time required for the investment to set and be ready for the burning out of the wax would necessitate our consideration of some one of the older or standard makes of investment.

The first to be used, and still used extensively, is that made by the originator and inventor of the casting process, known as the Taggart investment; and since one should be taken as a type, let this particular make be considered as applied to inlay work only.

Climatic conditions have an influence on the setting of all investments. Then, too, the amount of manipulation, together with the time spent at it, will have its effect on the time required for the investment to set. So there are several influences that play a part in the behavior of investment setting when the element of time is to be considered. Assuming that the investment has been manipulated as per the original instructions by Dr. Taggart, from thirty to thirty-five minutes would ordinarily be required for the investment to set before starting to burn out the wax. It is important that a wax pattern be allowed sufficient time to set after it is invested, but it should be remembered that no worse mistake can be made than to allow considerable time to elapse between investing the wax and the casting of the inlay. To allow these cases to stand, as they often do, for some hours, and sometimes over-night, is not conducive of the best results. As soon as possible after the investment is set, we should proceed to eliminate the wax.

Much apparatus has been designed for the burning out of the wax, all aiming to exclude the direct flame from coming in contact with the investment. This principle has its advantage, especially in the early stages of the burning-out process. At the beginning, the greatest care should be taken that the investment be slowly and gradually heated. This material is more easily injured at this time by a high heat suddenly applied than by the same heat

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later; not only by way of changing the form, but the high heat will cause such a rapid expulsion of steam and gases that injury to the walls of the mold is likely to result. So it is imperative that a low heat be maintained, especially in the beginning. Later, it can be slightly increased without too rapidly forcing the gases to evolve from within the investment, and as they are driven off, the heat can be further increased without fear of injury to the mass.

To determine the degrees of heat here required or attained with any degree of accuracy would be more or less impossible, as we have no apparatus that will measure this precisely, for the reason that it is impossible to place in the center of the investment or better within the mold itself the necessary instrument, and its location would be of vital importance. If gained at all, the center can only be approximated. There are several ovens on the market, each provided with some sort of thermal gage, and the result of experience generally has been that they do not give the definite and accurate information intended, for the reasons stated above. It is not uncommon today to find many of these additions to ovens either removed or more or less disregarded. The best that can be expected to be claimed for them is that they serve as a safeguard against excessive heat and indicate a range within which the limit of heat should be maintained. They simply, at best, indicate safety zones.

The other means of controlling heat and keeping it within desired bounds is that obtained from gas control, which, even when operated by a mechanically accurately constructed device, is not always constant, for the reason that gas pressure is not always equally maintained; and the same is true of electric current. So the heat control and management resolves itself into a combination of means and ideas best developed by a study of what actually takes place in this burning-out process, all of which is not fully known. But there are certain changes presented to observation from time to time as this process of elimination advances that are worthy of notice and will serve as a reasonably safe guide in procuring good castings of inlays. In the early stages, these changes are not so plainly visible unless the heat is excessive, and a "boiling over" of the wax is noticed. With this particular investment, this is a mistake, while with others it is desired. Beginning with a low heat, with the investment protected from direct contact with the flame, the heat should be increased at intervals of time ranging from five to ten minutes until a heat is acquired that is sufficient to drive off all gases and a greater part of the carbon, a residual of the wax. It is important to know rather definitely when this is accomplished, for, beyond this point, continued heat is unnecessary and detrimental and should therefore be discontinued. Negligence or inability to appreciate this particular time rather definitely in the elimination process is, I believe, more responsible for poor castings than any other one detail in this part of the work. This can be accomplished ordinarily in twenty minutes. Experience and careful observation will enable us to recognize when this residue is approaching its final elimination. It will be noticed that the gases will ignite and show a distinct flame. This is especially true in the larger cases, and as these die out, an expulsion of smoke follows. Soon this

ceases, and, almost at the same time, a narrow white ring will begin to show itself at the inner border of the flask and the outer edge of the investment. A test with a cold glass is likely to show the absence of any steam or moisture. It is now time to discontinue the flame. To pass this line in the least is to pass a danger signal.

The practice of eliminating the wax by a very low heat maintained for several hours, while possessed of many features favorable to good results, is impractical. Even with the shortest of methods, some gold foil operators claim that they can insert a foil filling in a given cavity of the smaller size in less time than is required to make a gold inlay, and if our distinguished chairman of this section were to make the challenge, I should probably acknowledge defeat if I were on the other side.

After the wax has been eliminated, the flask and investment, in cases of inlays, should be cooled; which is in contrast to the procedure in larger castings for denture or bridgework. This can be hastened by placing the flask near a slow stream of compressed air, until the flask is cooled to the temperature of the room. I believe that it is sufficient to chill it to the tolerance of the touch and I am satisfied that ideal results can be had at this temperature.

Many and varied have been the types of machines used for casting, and each has, in its respective operator's hands, done creditable work. It was interesting, and often no less amusing, to witness some of the contrivances at first employed for casting inlays. A short discourse on these alone would be of no ordinary interest and would undoubtedly abound in mirth. The original type of machine used for casting inlays was of the compression type. Designed by a master mind and wonderfully constructed in every detail, it has rendered the greatest satisfaction to those who were fortunate in securing one. Machines of this type are intended to exert a definite pressure on the molten gold in casting; a principle that is supported with much favor by our best operators. This principle was so well regarded that it was applied in the making of many other machines, which are used with much satisfaction, when we remember that inlays are being here considered. The other common principle employed in casting is that of centrifugal force. It is especially recommended for large pieces of work, even to the size of full denture bases. The question of casting machines has become almost entirely a personal matter and a further discussion of it would be productive of no good.

The pressure necessary for casting an inlay is less than it was at first thought that it should be. A high pressure is believed to cause penetration of the metal into the pores of the investment and beyond the wall of the mold, as well as a rebound that is not favorable to good results. A pressure as low as from 4 to 5 pounds on a liberal surplus of metal, which should always be used, is sufficient in most cases.

The carat of gold to be used for making inlays has been much discussed pro and con. It is generally conceded that 24 carat gold behaves most favorably for good casting. Particularly in large inlays, large surfaces of which are exposed to hard wear, it is condemned by many on account of its inability to withstand attrition. It is argued by some that this is a virtue rather than an evil, it being claimed that alloyed gold

would induce trauma. The filled tooth should take its share of the burden of the stress in mastication. To do this, the metal in the filling exposed to the forces of the opposing tooth or teeth should be of such resistance as to endure this wearing force reasonably well; and if the metal is not resisting, an equal function with surrounding teeth is not maintained. Where there is not so much demanded in the wearing quality of a filling, 24 carat gold will give excellent results, and particularly in the smaller inlays. The practice of using scrap gold mixed with gold solder should always be discouraged. It has no place in the practice of this work. Where a harder metal than pure gold is desired, the use of from 2 to 4 per cent platinum and 24-carat gold is strongly recommended, but to exceed 4 per cent of platinum, or at most 5 per cent, is to encounter some difficulty in securing an alloy that behaves most favorably for casting purposes.

With each casting, a liberal amount of metal, well cleaned, should be used. Cleaning can be done readily and thoroughly by melting gold on a charcoal block and adding for a flux 75 per cent borax ($NA_2B_4O_7$) and 25 per cent saltpeter KNO_3), previously mixed, and shaken on the gold while being melted. With this treatment, a metal free from foreign substances can be obtained. Credit for this method is given J. P. Buckley. Cleansing after casting is probably best gained by immersion in hydrofluoric acid.

A strong recommendation is made for a close observation of detail in the casting process, as was most wonderfully exemplified by its originator and inventor, in a manner that should be an ideal for all to follow, and one that has made, probably, the greatest impress on the professional mind that has ever been known in dentistry.

TREATMENT OF RANULA*

By MENIFEE R. HOWARD, D.D.S., Denver, Colorado

RANULA rarely comes to the attention of the dental oral surgeon, but when it does occur, it may be a stubborn condition and exact the most skilled services of the operator.

ETIOLOGY

It arises from an obstruction or irritation at the orifice or within the duct caused by the formation of salivary calculus, entrance of foreign bodies or trauma. The ducts or orifices most commonly involved are those leading from the submental, submaxillary or submucous glands.

Its symptoms are a chronic, slow or rapidly growing swelling, usually in the anterior part of the floor of the mouth. It is a bluish gray or even a reddish gray. It will not pit or dent on pressure and is usually tense.

DIFFERENTIAL DIAGNOSIS

A lipoma might be mistaken for ranula, but, on palpation, it can readily be differentiated, as the lipoma is soft and readily collapsible.

The treatment is always surgical and may be done by various means, depending on the history and development. The treatment of the smaller ranula or those of recent origin may be as follows: A simple incision is made into the ranula and the contents are evacuated. Phenol, full strength, is applied to the cut edges of the incision, which tend to retard immediate closure of the wound. The patient is observed daily for some time, and the opening thus established, is maintained. On account of the likelihood of the cut edges healing and closing, this method is successful in only a small percentage of cases. A more satisfactory and practical method is as follows: A V or oval shaped incision is made in the superior portion of the ranula and the flap turned under and sutured to the remaining cyst wall so as to make a smooth surface. This method will prevent the closing of the wounds and is successful in a large percentage of cases. The anesthetic used may be either procain or gas oxygen, or other general anesthetics, depending on the judgment of the operator.

Blair recommends, in many cases, the complete excision of the ranula, but on account of such an operation being a serious one, this radical operation should be approached cautiously and only after other more conservative procedures have failed.

Brophy's treatment, by means of the silver ring method, is as follows: A silver tube with a gage of 3 mm., curved so as to form a circle one-half inch in diameter, is used. The ring is perforated with many holes. Two punctures are made in the cyst wall,

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and the ring is placed through one opening and then the other and the ends of the ring are telescoped. This is allowed to remain until the freshened tissues heal around the ring, thereby establishing a permanent drainage. The tube is rotated daily to prevent the formation of granulation. Heavy waxed braided silk, or even silver wire, instead of a silver tube may be used.

REPORT OF CASE

In a case of ranula, resulting from trauma to Wharton's duct, the patient, a man, aged 50, and weighing 150 pounds, while at a railroad roundhouse accidentally fell into a pit, landing on and injuring his left jaw. A swelling developed on the left jaw and in the mouth, lasting several days.

The patient's description of the case was as follows: For fourteen years after this accident, at intervals of one or two years, there was a hard swelling of tissue under the tongue, occurring after a cessation of the saliva on the left side. For the first eight years, this condition occurred every two years, and for the next six years it occurred once annually. The cystic sac developed during such disturbances, and after a few days, would break spontaneously, after which the conditions about the face and jaws would return to normal. The last attack, just preceding the time the patient came in, had lasted about four months, and had developed into Ludwig's angina. The patient also reported that, during the past three years, he had a feeling that an enlargement under the left jaw was in process, in the submaxillary region. At the clinical examination, a diagnosis was made of pus in the submaxilliary glands and other glands of the neck. Subsequent operation confirmed this diagnosis. Drainage was maintained for about six weeks, during which the pus condition subsided, and the swelling also subsided and tenderness disappeared. About three months after the original incision, two large salivary calculi, each the size of a thumb, were removed from the left submaxillary glands, together with the glands. Two years have now elapsed since the operation, with no report of further disturbance or swelling under the tongue. The ranula within the mouth disappeared after the above described operation.

CONCLUSION

It should always be remembered that, in most cases, the walls will reunite and the ranula recur unless a permanent opening is maintained. For this reason, an operation for ranula should not be considered too lightly on account of the danger of recurrence. When an operation has been decided on, it should be done with such care, skill and definition that the chances of recurrence will be largely eliminated.

THE VALUE OF THE ROENTGEN RAY IN ORTHODONTIA*

By L. M. WAUGH, D.D.S., F.A.C.D., New York City

WHEN the invitation came, urging the preparation of a paper on the value of the roentgen ray in orthodontia, my immediate reaction was to question the need for such a contribution to dental literature. For more than a decade, radiograms had been most freely used as daily routine and considered an absolute essential to honest practice. However, I conferred with several of my colleagues in orthodontia whose conviction and practice I knew to coincide with mine, and they convinced me that, in many practices, treatment is begun without preliminary radiographic examination, and that radiograms are obtained only when adverse progress forebodes unsuspected abnormality.

To the end that the report might be a representative expression of opinion of a group of leaders in the specialty of orthodontia, the following questionnaire was sent to fifty practitioners.

QUESTIONNAIRE

1. Do you regard the unrestricted use of radiograms as being essential to honest orthodontia?

2. (*a*) Do you consider an intelligent diagnosis and outline of treatment possible without a radiographic examination?

(*b*) What conditions do you especially take into consideration?

3. In your opinion, is it essential to have radiograms of *all* regions of the mouth or only the areas in which so-called "permanent" teeth are unerupted?

4. Should a firm, healthy deciduous tooth *ever* be extracted without a radiogram to determine the presence of the so-called "permanent" successor?

5. (*a*) From your clinical observation, at what age, as a safe working average, does the third molar follicle show radiographically?
(*b*) What is the earliest age at which you have observed it?
(*c*) What is the latest age before it has shown?

6. (*a*) Do you use *extra*-oral poses in routine technic?
(*b*) If so, what positions?
(*c*) For *intra*-oral examination, how many films for a complete set?

7. For *differential* diagnosis, what poses do you use?

8. (*a*) In regular routine practice, how frequently do you consider reradiographing necessary—not for research or special investigation?
(*b*) If so, for what purposes?

9. Do you consider it possible from radiograms of the developing tooth follicles to foretell the sizes of the future teeth with sufficient accuracy to permit predetermination of the size of the fully developed dental arch?

10. (*a*) Do you invariably make a record of the angles from which exposures are made so that they may be duplicated?
(*b*) In routine practice — not research—do you consider it *best* to do so?
(*c*) Do you consider it *essential*?

*Read before the Section on Exodontia, Anesthesia and Roentgenology at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

11. (*a*) Is the radiography done in your own office?
(*b*) Why?

12. Will you kindly add any information that you consider important in such a report? May I quote from your answers?

Please be assured that the answers will be so used that no embarrassment will be occasioned. The object is to express the *consensus* of best opinion. Kindly be assured of my gratitude.

Faithfully yours,
L. M. WAUGH.

TABULATION OF ANSWERS

1. Do you regard the unrestricted use of radiograms as being essential to honest orthodontia?

"Yes," 37. "Absolutely," 3. "No," 4. "Emphatically yes"—A. H. Ketcham. "I sure do, freely and often"—J. A. Gorman.

Conclusion: The unrestricted use of radiograms is essential to honest orthodontia.

2. (*a*) Do you consider an intelligent diagnosis and outline of treatment possible without a radiographic examination?

"No," 34. "Yes," 3. Unanswered, 7.

(*b*) What conditions do you especially take into consideration?

"Absent follicles," 16. "Supernumerary teeth," 12. "Impacted teeth," 14. "Malposed teeth," 10. "Position of follicle and direction of root formation," 2. "Pathologic conditions," 8. "Lack of resorption of deciduous roots," 2. "Lack of jaw area for third molars," 2. "All—no exceptions—so many unsuspected conditions are frequently found"—F. R. Blumenthal. "Internal diameter of internasal fossa, naso-antral, also the states of the unossified intermembranous sutures"—G. M. Wright. "Any deviation from normal in size, number or location of the teeth, and any disease which the roentgen ray might reveal"—H. E. Kelsey. "Extent of development and calcification of permanent teeth (unerupted) for the age of patient. Length of roots of deciduous teeth . . . to observe the shape, volume and structure of the bone"—J. D. Eby. "Misplaced, missing or impacted teeth, or abnormal roots"—G. Northcroft, England.

Conclusion: A preliminary radiographic examination is essential to correct diagnosis and outline of treatment.

The conditions to be observed are: (*a*) absence of tooth follicles; (*b*) position of follicles; (*c*) length, shape, and direction of root formation; (*d*) supernumerary follicles; (*e*) impaction threatened or established; (*f*) lack of resorption of deciduous roots; (*g*) lack of jaw area for third molars; (*h*) condition and thickness of alveolar process, and (*i*) pathologic conditions, threatened or established.

3. In your opinion, is it essential to have radiograms of all regions of the mouth or only the areas in which so-called "permanent" teeth are unerupted?

"All regions," 27. "Only areas with unerupted teeth," 12. Unanswered, 5. "All regions"—Ketcham. "All teeth, also the thickness of mandible and ramus"—Wright. "All regions with extra-oral plates to include adjacent structures"—Kelsey. "All the regions of the mouth including the third molar areas"—J. Lowe Young. "All regions in every case"—C. R. Baker. "As a rule, only the latter unless there is reason to suspect other conditions"—Harold Chapman, England. "All regions. Frequent distortion of roots of developing permanent teeth demand it"—R. C. Willett.

Conclusion: All regions of the dental arches and contiguous structures must be shown in the preliminary radiographic examination.

4. Should a firm, healthy deciduous tooth ever be extracted without a radiogram to determine the presence of the so-called "permanent" successor?

"No," 41. Unanswered, 3. "Absolutely not—Burt Abell.

Conclusion: A firm, healthy deciduous tooth should never be extracted without a radiogram to determine the presence of the so-called "permanent" successor.

5. (*a*) From your clinical observation, at what age, as a safe working average, does the third molar show radiographically?

"10 years," 6. "12 years," 10. "14," 3. "16," 1. Unanswered, 24.

(*b*) What is the earliest age at which you have observed it?

"7½ years," 4. "9 years," 4. Unanswered, 36.

(*c*) What is the latest age before it has shown?

"13 years," 4. "14," 2. "15," 1. Unanswered, 37.

Conclusion: There is wide variation in the calcification of tooth follicles, especially the third molars. It is not safe to state positively that the third molar is congenitally absent as shown by radiographic examination until about the fifteenth year, although the great majority are plainly visible at the twelfth year.

6. (*a*) Do you use *extra*-oral poses in routine technic?

"Yes," 16. "No," 14. Unanswered, 14. "Yes—5 by 7 inch film in cassette"—Eby.

(*b*) If so, what positions?

"Right and left lateral films," 6. Unanswered, 38. "For molars and bicuspids and sometimes to include cuspids direct the ray from back of the angle of the mandible forward and upward on a line with the cuspid of the opposite side"—Ketcham. "Anteroposterior and profile of head at definite focal distance and same angle"—Wright. "To include ramus of mandible and bicuspids if possible."—Kelsey. "Right and left views with tube pointed through the angle of the mandible"—Young.

(*c*) For *intra*-oral examination, how many films for a complete set?

"Four to six, depending on age," 1. "Seven," 2. "Eight," 6. "Ten," 22. "Twelve," 8. "Fourteen," 6. "Regular routine ten to fourteen. If impacted or supernumerary teeth are shown to be present, three for each of these teeth"—Ketcham. "Depends on age and number of teeth erupted—varies from ten to fourteen films"—Frank M. Casto. "Five uppers, regular size film, or three uppers No. 1 size and two large; one or two lowers of anteriors always make lateral views extra-oral on 5 by 7 film in cassette"—Eby. "Four or six, depending on age of patient"—Young. "About eight in addition to right and left extra-oral lateral views"—Suggett. "For deciduous arch, usually upper four and lower three"—Willett.

Conclusion: *Extra*-oral poses are essential to a complete examination of the dental arches and contiguous structures. For routine examination, a right and left lateral view on a 5 by 7 inch film in a cassette, one half of each side, is sufficient. For *intra*-oral examinations for deciduous arches, eight films are sufficient; ten films for older patients. The simplest satisfactory rou-

tine technic consists of two extra-oral and two intra-oral views; the extra-oral being right and left lateral poses on a 5 by 7 inch film in cassette; the two intra-oral being made on No. 3 films, one of the upper anterior six teeth and the other of the lower anterior six, the teeth being closed upon the films.

7. For differential diagnosis, what poses do you use?

Answered by thirteen as follows: "Antero-posterior of head," 2; "profile view of head," 1; "occlusal view," 4; "submaxillary," 4; "lateral," 8; "intra-oral," 3; "of each suspected area," 1; unanswered, 31; "prefer sterioscopic radiograms," 3; "one exposed directly over the tooth, and one a little to the right and one to the left"—Ketcham.

Conclusion: For differential diagnosis, both extra-oral and intra-oral are necessary, depending on the individual case. The extra-oral consist of (*a*) lateral, occlusal and submaxillary poses and (*b*) anteroposterior and profile of head taken at same angle; the intra-oral, of at least three poses at different angles of each region.

8. (*a*) In regular routine practice, how frequently do you consider re-radiographing necessary—not research or special investigation?

"Every 3 months," 3. "Every 6 months," 9. "Every 12 months," 5. Unanswered, 27.

(*b*) If so, for what purposes?

"To determine condition of roots and process and to check formation, eruption of teeth"—Ketcham. "For tissue change and position of teeth"—Casto. "To study everything previously revealed and to watch something known or suspected"—Eby. "To determine progress of development"—Young. "Chiefly for what alteration, if any, has taken place in the positions of unerupted and misplaced teeth"—Badcock.

Conclusion: For regular routine practice, it would seem best to reradiograph at twelve-month intervals; if much bodily movement is necessary or disease suspected, at intervals of three to six months; in special cases, as frequently as once each month.

9. Do you consider it possible from radiograms of the developing tooth follicles to foretell the sizes of the future teeth with sufficient accuracy to permit predetermination of the size of the fully developed dental arch?

"No," 34. "Absolutely not," 3. "Yes," 1. Unanswered, 7.

Conclusion: It is impossible to foretell from radiograms the sizes of the future teeth with sufficient accuracy to permit the predetermination of the form of the fully developed dental arch.

10. (*a*) Do you invariably make a record of the angles from which exposures are made so that they may be duplicated?

"No," 32. "Yes," 6. Unanswered, 6.

(*b*) In routine practice—not research—do you consider it *best* to do so?

"Yes," 30. "No," 3. Unanswered, 11.

(*c*) Do you consider it *essential?*

"No," 30. "Yes," 3. Unanswered, 11.

Conclusion: It is best, but not essential, as routine practice, to make a record of the angles from which radiograms are made so that they may be duplicated. Such record is essential in

differential diagnosis, especially that involving disease and in research.

11. (*a*) Is the radiography done in your own office?

"Yes," 21. "No," 23.

(*b*) Why?

"Yes, for convenience," 11. "Yes, for efficiency," 19. "Yes, patients prefer it," 3. "Yes, unsatisfactory when sent out," 7. "No, to save time," 7. "No, lack of space," 5. "No, expert convenient," 11. "I can procure special angulations desired and believe the child prefers personal service"—Blumenthal. "Greatest accuracy"—Ketcham. "For obvious reasons" — Casto. "Radiography and the equipment necessary is just as much a utility as any office instrument. It is needed for convenience and facility"—Eby. "In order to know the angle at which previous views were taken"—Young. "Because I know what I want and can retake immediately if required"—B. Maxwell Stephens, England.

Conclusion: For efficiency and convenience, it is best that radiograms be made in the office of the orthodontist. An exception seems feasible when an expert radiographer is so close that the orthodontist may be present in unusual cases when the exposures are made.

12. Will you kindly add any information that you consider important in such a report?

"Impress on the orthodontist the necessity of the liberal and constant use of the roentgen ray"—Casto. "Radiograms are only valuable when properly made, and I consider that 50 per cent of their value lies in proper interpretation"—O. W. White. "I do not think roentgen rays should be advised unless absolutely needed as the patient should not be put to unnecessary expense."

Conclusion: Radiograms can be produced in the office at so small an expenditure of time and money that the cost is negligible, and as many as needed during treatment should be included as a part of the general fee for service.

SUMMARY OF CONCLUSIONS

It is earnestly hoped that this report may be the means of acquainting practitioners in all branches of dentistry and medicine with the fact that the unrestricted use of radiograms is essential to honest orthodontia, and of convincing those orthodontists who have not as yet awakened to this fact.

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Editorial

THE UNDERGRADUATE

At this season of the year, the various classes in our dental schools are well under way for their winter's work, and it is important that the profession as a whole take some interest in this potential body of young men and women. The undergraduate should be of concern not only to his teachers but also to every practitioner of dentistry.

It is seldom that the profession stops to realize the significance or the possibilities that lie in this very alive entity known as the undergraduate, or the problem that is presented in trying to assimilate him into our professional ranks. To take the average young man direct from high school or college with the point of view gained by contact only with academic association and with society wholly outside professional life, and instil in him the fundamental conception of what a profession really means, is no small task. And it is a task the essential necessity of which even many of our teachers in dental schools do not seem to fully realize.

These young men with all their splendid possibilities—possibilities which in the main lie undeveloped at this period of their lives—should make an especial appeal to their teachers for instruction and direction along lines which, up to this time, have been, for the most part, foreign to them. The teacher usually takes too much for granted. He seems to assume that, without question, the undergraduate, from the very beginning, must be possessed of a professional point of view. How can he? What has given him this point of view? What opportunity has he had to acquire or absorb the professional spirit? His experience up to the time he enters dental school has seldom contributed one iota to the development of a correct attitude toward professional life. He has never learned the fine distinction between a professional occupation and a business occupation. No high ethical resolve or altruistic impulse has impelled him to select dentistry as a calling. Let us not blink at facts. Let us take the boy exactly as he is and deal with him as we find him—not as we wish we had found him.

Nine times out of ten, the incentive which makes a young man take up the study of dentistry is the fact that he thinks he will "do well" at it. His motive may not be entirely mercenary, but it is usually perilously near to it. And for this the boy is not to be blamed. He is merely following the first law of Nature, and while his motive cannot be called altruistic, it must at least be called wholly legitimate. If he looks on dentistry merely as a means of earning a living and acquiring a respectable position in the community, we must remember that these two achievements are at least one requisite for good citizenship. And good citizenship is the fundamental basis of our civilization.

But, in the professions, we believe that there is some higher incentive than this to bring out our best endeavors—something that makes a stronger appeal and assures a sweeter reward even than the making of money. The best recompense which the professional man gets is not financial. After the necessities of life are cared for, the need of money is negligible, but the real incentive in life—the one supreme thing for which life was

destined and without which life is never complete—is the opportunity to serve one's fellowmen in the making of a better world. It is this kind of service that brings to a man his happiest experience, his surest satisfaction and his most substantial reward.

In entering a profession, therefore, the young man is really approaching possibilities of happiness that never occurred to him—of which, in fact, he was ignorant—and it is one of the duties of the teacher in a professional school to point the pupil to this prospect and make him realize as early as possible what professional life actually holds for him. If the student is given this vision in the beginning of his college course, it will do much to lessen the tedium of his work, and will inspire him to greater effort and higher resolve.

We should look on our undergraduate as a real entity and a potent possibility not to be overlooked or ignored, and as a tangible asset to the professional life of the future. We should not assume that we must wait till after his graduation to give him a glimpse of what professional life means in its best consummation. It really takes considerable time to develop in the average individual the highest conception of ethics and a true professional spirit, and we should begin at once with our students the moment they enter dental school. As has been intimated, we cannot expect the undergraduate to grasp the full significance of his future relationship to society, or to visualize what the practice of a profession has in store for him. To him, professional ethics is vague and chimerical, even if, indeed, he recognizes it at all.

What better service can we perform for our students than to train them in a correct attitude toward their life work? If we are to make real dentists of them, it is as necessary that we do this as it is that we give them technical instruction; and yet, in the average curriculum, little stress is placed on the teaching of ethics compared with the attention that is given to the so-called "practical branches," and almost nothing is said of the really inspirational relations of professional life. It is, of course, essential that the science and art of dentistry be taught, but it should also be considered just as imperative that we point our students to the

way of the most exalted conception of what professional life may mean to them in the way of sublimity of service. To go one step farther, the teacher should not be considered quixotic or lacking in practicality of purpose if, at times, he ventures into the rarer atmosphere of idealism and dwells on the sacredness of self-sacrifice. Without self-sacrifice, professional life can never achieve its destined function in the great scheme of human endeavor, and the undergraduate should be taught this of all other lessons.

If, in the past, we have, in a certain sense, failed with our students—if we have waited till after graduation to let them acquire, as best they may, a vision of those high principles of professional purpose which go to make up the best there is in professional life, and without which this life can never be complete, let us begin to remedy our fault by starting early in student days to emphasize this phase of their career, and make it a definite and distinct part of their college training. In this way only shall we do full justice to the undergraduate.

DR. WILLIAM H. TRUEMAN

Dr. Trueman died August 4 in his eighty-fourth year. He was born in England in 1842 and the family came to America in 1846. In 1857, he began the study of dentistry in the office of Dr. Henry Winterbottom. He was graduated from the Pennsylvania College of Dental Surgery in 1865, and practiced his profession in Philadelphia for more than fifty years.

His career was a most honorable one. He always stood for the best there is in ethical dentistry, and the profession gave back to him in homage and in honors its full meed of appreciation. He held various positions in dental schools and societies, and was on the editorial staff of the *Dental Brief*. His contributions to dental literature were extensive, and his treatment of any subject consigned to him was marked by a high degree of intelligence, and by a finished diction.

His chief service in this connection was associated with the various phases of dental history, on which subject he was an authority. His unswerving adherence to fundamental fact was one of his most pronounced characteristics, and when Dr. Trueman made a statement every one knew that it was true.

His passing leaves a distinct void in our professional ranks, and this is made all the more conspicuous because of the fact that the outstanding men of his generation are growing pathetically few. He has left a record which men of the present day would do well to emulate.

BOOK REVIEWS

DENTAL EDUCATION IN THE UNITED STATES AND CANADA. A Report to the Carnegie Foundation for the Advancement of Teaching. By William J. Gies, with a preface by Henry S. Pritchett, President of the Foundation. New York: The Carnegie Foundation for the Advancement of Teaching, 1926.*

The completion of a report to the Carnegie Foundation for the Advancement of Teaching, written by Dr. William J. Gies of Columbia University, entitled "Dental Education in the United States and Canada," marks the beginning of a new era in the progress of dentistry.

To review a work of such intensive research briefly, yet adequately, is an impossible task for the writer. And so this presentation takes the form of appreciation, with comments on the extent and quality of the report and on some of its significant pronouncements.

The report is a colossal contribution to the promotion of better health service, not only through dentistry but through medicine and other health service agencies as well. It discusses dentistry not as a mechanical art but primarily as a health service, a viewpoint comparatively new. To the layman and to many others, dentistry appears to be merely the art of dealing with the abnormalities and defects of the teeth; but this report of Dr. Gies shows conclusively that dentistry is more than that: it is inseparably allied with the practice of general medicine, with the fundamental medical sciences and with the furnishing of health service to the community. Dentistry can no longer ignore its undeniable connection with the whole field of medicine. The author points out that the interrelation between medical and dental education and also medical and dental practice is becoming increasingly more intimate; which must in time result in closer relationship between the two professions.

This report is not a technical survey, intelligible and of interest to experts alone. It is, rather, a judicial, easily understood treatise on the present weaknesses and deficiencies and possible improvements in our system of education for the profession of dentistry. Its prevailing thought is better oral health service. Its purpose is to raise the standards and to enlarge the usefulness of such service in every practical manner. The spirit is one of openminded investigation, similar to the attitude of a report on medical education issued in 1910. It hopes to do for dental education what that earlier report did for medical education, drawing the attention of the scientific men of the country to a pressing need. Dr. Gies has no desire except to place dental education on a parity with the best medical education of today and that of the future; his report is in no sense propaganda for whatever individual ideas he may hold. The wisdom and the completeness of the report are bound to create a hitherto unknown interest in the current problems of dental education. He reminds us that medicine and dentistry are public possessions solely, and that the relations and activities of the two must be kept subordinate to the interests of community welfare.

This invaluable report required five

*The review presented here is preliminary to a more extended review by Dr. Midgley.

years of constant application and intensive study, with unlimited sacrifice on the part of the author. Reflecting a wide range of understanding and a deep sincerity of purpose, it aims to elevate the standards of dentistry in all its aspects, cultural, technical and professional, and to place dentistry in its rightful position among the arts of healing. Presented interestingly and convincingly, after exhaustive study and analysis of theories, conditions and facts, it should command the serious attention and concern not only of teachers, practitioners and students of dentistry, but also of all interested in any form of health service education.

The exceptional manner in which the study was conducted; the unusual display of skill and ability with which trying situations were met and vexing problems solved; the tact and diplomacy with which many of the opposing individuals and agencies were brought to a closer understanding, and the logic and solidity of the conclusions which should raise dentistry from uninspiring surroundings of mediocrity to a plane of greater usefulness and excellence—all these qualities of the report are extraordinarily impressive.

The author has blazed a trail that must overcome unfortunate conflictions, and the work he has done is destined to lead to results of enduring value. In recognition of his attainments and service to the professions and the public, his name and activities will be linked forever in the annals of dentistry with those of Harris and Hayden.

The report, in scope, content and quality, is all that could be desired. The text covers all phases of the subject completely and accurately. The style is unusually effective; the conclusions are enlightening, and the proposed solution of the dental educational problem is unique and supported by convincing argument.

The ability of the author and the quality of the effort are clearly shown throughout the entire presentation, and his tireless energy and devotion to dentistry are plainly evident in the precise and unusual quality of detail work. It should be of immeasurable value to those interested in the promotion of dental education.

The statistical data, both the comparative and those on each school, are most informing. If one needed corroborative evidence to support the truth of statements or the accuracy of the opinions and conclusions, a thorough examination of them in Part VI and the appendix will convert the most incredulous.

Moreover, a review of the book would be far from complete unless mention were made of the author's mastery of the language. His ability to use clear, forceful English not only makes the report genuinely pleasant reading but also enables the reader to comprehend precisely the author's meaning. His choice of words is felicitous, and the whole presentation is unusually effective. What must appeal strongly to all, whether or not they are interested in the promotion of dental education, is the clarity of the report and the soundness and potential adaptability of his solution of the dental educational problem.

Dr. Gies has evolved a number of orderly conclusions, one of the most important of which is that dentistry cannot longer be ignored in the training of general practitioners of medicine and that reorganization of the dental

educational program is needed to effect an equilibrium between the two sciences which does not now exist, and which, in justice to the public welfare, should be attained. The author believes education for physicians should include instruction in oral hygiene and clinical dentistry, while, at the same time, the preparation for dental practice should provide training in oral medicine. Obviously, better health service through the improvement of the medicodental relationship requires this coordination.

The readers will agree with the author that further advancement in dentistry is dependent on progress in dental education. As an effort to further this progress, the author proposes a reorganized system of education founded on the conclusions that he has formulated as a result of his investigations. These conclusions are based upon the conceptions (1) that dentistry is health service primarily, and (2) that dentistry should be fully equivalent to the oral specialty of the practice of conventional medicine in service value to the patient.

It is held by the author that dentistry, because of hitherto separate development, and unique mechanical and esthetic requirements, can attain its most desirable growth as an agency of health service by continuing as an independent profession, but it is urged that dentistry, in order to attain the widest usefulness, must be promoted by a reorganized system of education that will insure its professional equivalence to the oral specialty of medicine.

To achieve this end, Dr. Gies proposes the "two-three-graduate" plan, which provides: 1. A liberal education of at least two years of academic study of such content that it will be a test for the genuine vocational adaptability of all students entering the predental course. This test will serve as a sound basis upon which to begin undergraduate studies. 2. At least three years of intensive and well integrated work in an approved dental school for training general practitioners only, the years to be lengthened wherever desirable; the student, at the end of his three professional years, graduating as a general practitioner knowing how to begin safely a dependable general practice and "possessing peculiar capacity to grow." The reduction in the number of undergraduate years in the dental school from four to three does not mean, however, less professional training, for, with a curriculum properly coordinated and unified, the student will be trained to view all his courses as bearing directly on his field of study rather than belonging to separate departments of knowledge. 3. An optional, supplementary, graduate year, for advanced training in all types of dental and oral specialization which should automatically promote research and improve methods of teaching in and insure better teachers of dentistry. 4. A combination of medical and dental curriculums for the development of the more difficult aspects of oral medicine, which should assist effectively in the promotion of cordial cooperation between medicine and dentistry. The plan aims to have dentistry profit by some of the assets of medical teaching. Ideal in theory and attainable in practice, the soundness and serviceability of the plan should commend itself to all from the standpoint of altruism and progress.

The preface, written by Dr. Henry S. Pritchett, covers the entire field of the survey interestingly and con-

clusively. His health service ideal offers a program that should yield the greatest measure of proficiency in practice and the widest degree of usefulness in public welfare; his eight propositions following definite and irrefutable premises may be aptly termed the beatitudes of future dentistry, as the perfection of dental health service is encompassed by them.

Dr. Pritchett states

> The dental school is one of the most important of these agencies (for the training of a qualified body of public health servants) . . . . The facilities for the education it seeks to offer cannot be furnished on a commercial basis. It must have generous financial help, such as has been accorded in the last ten years to many of our medical schools, if it is to carry out its duty to the public health service. There is today no more direct method by which the public health can be served than to enable the universities to place their dental schools in a position to give the kind of education for which the world stands in need.

His urgent plea for adequate financial support should appeal strongly to those in a position to give endowments. The dental profession is keenly sensitive to the vision of its future usefulness presented in the Carnegie Bulletin. Improvements there suggested will be rapidly forthcoming if the dental schools in the universities can be given the financial support that their needs warrant. With dentistry elevated to the educational standard of an oral specialty of medicine, yet a profession separate from it, proper mediums for more scientific advancement should be forthcoming in endowment form. When an equality between the two professional standards which Dr. Gies proposes can be achieved, those who can endow will.

If you would know American dentistry, the warp and weft of its historical, statutory, organizational, educational, and financial fabric, study the entire volume. If you have not the time for that, study the Preface and Chapter XII, "General Views and Conclusions," pages 225 to 240, particularly pages 239 and 240. If you cannot do that, reflect on this quotation, which is the quintessence of the book: "To advance with cumulative success as a mode of health service, dentistry, represented by the great body of independent general practitioners, must be intellectually vigorous, mechanically facile, esthetically felicitous, medically competent, ethically sincere, professionally keen, and socially altruistic."

In passing, one should pause to give gratitude to the Carnegie Foundation for making possible to the dentists of the United States and Canada this stimulating, helpful Bulletin. It is invaluable to the entire dental profession of the world. Let us hope it foreshadows the "dawn of the days to be"!

To Dr. Gies is due the sincerest thanks of all dentists; not solely for the finiteness of the book, but also for the ennobling attitude that undertook it. Most fortunate is the Carnegie Foundation in having secured his services.

ALBERT L. MIDGLEY, D.M.D., Sc.D.,
Providence, R. I.

PROCEEDINGS OF THE FIRST INTERNATIONAL ORTHODONTIC CONGRESS. Held at New York City, Aug. 16-20, 1926. Pp. 767, with numerous illustrations. St. Louis: The C. V. Mosby Company.

This volume is unique in dental literature. When we consider the fact, that, in one specialty of our profession, a congress has been held with a very large attendance at which approximately one hundred papers and case reports

were given, and this all gathered in one compact volume, it speaks eloquently for the genius embodied in this specialty. Fifty years ago, all that was authentic in the entire realm of dentistry might have been encompassed in a volume of this size, and it should add to the pride of the profession that a single specialty can make such a demonstration as this. It is needless to say that the contents of this book consist of the latest in orthodontic theory and practice, and that it contains the ideas of the greatest thinkers in this specialty the world over.

We extend our congratulations to the officers and members of this Congress and commend their proceedings to the attention of all those who are interested in the subject.

THIS TOOTH PROPOSITION. Dealing with Problems that Give Importance to the Ever Popular Subject of Teeth. By M. J. Reidy, D.D.S., Graettinger, Iowa. Pp. 179. Published by the author.

The object of this book is to present to the public the kind of information that most patients need in connection with their teeth. It is to amplify the instructions usually given by dentists when the patient is in the chair, and to get this knowledge to the individual before it is too late. An idea of the scope of the book may be had by reference to the various chapter headings, which are as follows: "Teeth and Their Care," "Good Teeth and Good Health," "Bad Teeth and Other Diseases," "Prevention," "Examinations, Advice and Fees," "The Great Need," and "Oral Hygiene in the School." Many subheadings are, of course, given, and much valuable advice. Reference is made to the work done in the Bridgeport schools, and particularly to what is being accomplished in the State of Virginia. The "Virginia Plan" is described at some length for the benefit of those who would care to inaugurate a similar service.

The book is well printed, with clear type, and is easy to read.

DEPARTMENT OF DENTAL HEALTH EDUCATION

HOW MODERN NUTRITIONAL RESEARCH TOUCHES DENTISTRY*

By E. V. McCOLLUM, Ph.D., Sc.D., Baltimore, Maryland

SHREWD observers have doubtless known for many centuries that certain systems of feeding farm animals are superior to other systems in the results they give. The history of research in animal nutrition has brought to light the fact that certain combinations of foods are of special value in inducing growth in young animals. It has been demonstrated that, almost without exception, individual natural foods as they come from the farm are incapable, irrespective of their chemical composition as shown by even a searching analysis, of supporting normal development in growing animals. It has been further established that certain combinations of foods are superior to either component of the mixture because one supplies one or more nutrient principles which are lacking or deficient in the other. A series of diets, using ordinary food substances, can now be prepared which may be graded from poor through good to excellent in respect to the manner in which they will promote growth in the young.

Studies on milk production have shown that the amount and quality of milk which the lactating female produces is dependent on the character of her food. The principles involved are the same as those concerned in body growth.

Aside from the use of food for yielding energy, a property possessed in common by fats, carbohydrates and proteins, we have in proteins a special function as a structural material for the body tissues. The well known differences in the biologic values of proteins from different sources are due to the differences on their yields in digestion of the eighteen or twenty amino-acids of which they are composed.

Modern nutritional research has brought to light a far greater importance of the composition of the inorganic or mineral moiety of the diet than was formerly appreciated. An outstanding example of this is seen in the well-demonstrated relation between iodin starvation and simple goiter. Another example is the importance of appropriate relationships between calcium and phosphorus in the diet in respect to total content and proportions or ratios. It is still not clear whether certain other elements which are regularly present in the body in small but significant

*Read before the Baltimore City Dental Society, March 14, 1927.

*From the School of Hygiene and Public Health, The Johns Hopkins University.

amounts are indispensable for life and health. In this category are fluorin, manganese, aluminum, silicon, copper, arsenic, etc. It is quite possible that one or more of these may be of very great importance in nutrition.

At the present time we have evidence which is satisfactory to nearly everyone that there are at least five vitamins. These differ from other food principles in that we require surprisingly little of them; yet they are absolutely indispensable for the maintenance of life and health. It would be out of place here to recite the facts which are known about the effects of omitting one or another of these principles from an otherwise complete diet. There are accounts of many researches on the pathology of the deficiency diseases in the books dealing with the interpretation of the results of modern nutrition experimentation.

As dentists, you will be interested in a discussion of the principles which have been made clear through nutrition studies having a bearing on the quality of the teeth and their resistance to disease, and the possible rôle which the diet may play in promoting or preventing dental disease.

A question of paramount importance is whether there is a nutritional factor operating during prenatal life, infancy or childhood which determines the perfection and quality of the teeth and their positions, whether normal or misplaced or crowded. The position of the teeth is important in influencing their resistance to decay. The facts available are in great measure the product of animal experimentation.

For years, Dr. Nina Simmonds and I have maintained a large rat colony for experimental studies in nutrition. For the purpose of avoiding diseases and parasites, as well as of insuring a supply of animals which are of nearly uniform and high vitality, we have inbred our stock animals for sixteen generations. A new lot of young are saved each winter to serve as breeding stock the following winter. All animals are discarded before they reach the end of their period of fertility, which is, under good management, approximately fifteen months. Our entire colony is, therefore, thoroughly inbred. All individuals are very closely related, even closer than brothers and sisters; for doubtless it has happened many times that animals have been saved which were the progeny of brothers and sisters. I mention this because of the significance of the fact that our rats have a common inheritance. They are essentially well endowed physically at birth. Since all of them spend their entire lives in the same room, are affected by the same conditions of temperature, ventilation and cleanliness, and have the same opportunity for exercise, there is no factor other than the diet, which is modified according to plan, which has any influence on the physical condition, health and longevity of the experimental groups.

We have now tested more than 4,600 formulas, each of which was devised for a special purpose. The dietary properties of each of these can be described in some detail, and its deficiencies can be definitely evaluated. In most instances, we have actually determined by the addition of known substances, or the reduction in the amount of some one or more components, just what modifications of these diets are necessary to correct their defects. Most of these studies were made for purposes

other than the study of their effects on the teeth, but, as a by-product, a great deal has been learned about the quality of these structures. For over a year, we were fortunate to have the cooperation of Dr. Clarence J. Grieves, who examined and described the skulls of a large number of our experimental rats. We gave him data as to the kinds of diets and the deficiencies of each. These results have been published.[1] Dr. Grieves' findings led us to conclude, so far as our limited data would warrant, that the percentage of oral defects was greatest in those rats fed diets deficient in protein, calcium and vitamin A. The rats on the diets low in calcium exhibited the next highest incidence, and those on diets low in both calcium and vitamin A had the third highest percentage of damage.

The diets which were low in calcium and high in vitamin A, those containing low or defective protein, together with low vitamin A and those in which the only known deficiency was vitamin A formed a middle group producing 11.1 per cent oral defects. The oral tissues were the least damaged by the following diets: those high in calcium and low in vitamin A; those high in both calcium and cod-liver oil, and those low in calcium and in cod-liver oil. No caries-like lesions, pulp exposures or osteodentin, attaching tissue or maxillary defects occurred in rats on certain of the best diets. In the latter groups, there were but 0.36 per cent of defects, and these were the result of fractures or overgrowth. In other groups in which six or seven characteristic diets were fed, but all having common defects, the loss of attaching tissues and teeth or both, in the molar group, the percentage of incidence of defects observed was as high as 57.9. Other groups had from 33 to 35 per cent of these same defects. Thirty-seven per cent of the animals examined on thirteen different diets containing two varieties of defects showed pulp exposure. Maxillary and mandibular damage ranged from none on an excellent diet to as high as 45 per cent in animals on five different diets. The same lesions were tabulated for other groups in percentage as low as zero, with several intermediate values in other experimental groups.

The number of pulp exposures varied in the different groups in comparable degree. The significant fact brought out by this research was that rats fed monotonously on an excellent diet for more than a year showed no appreciable number of lesions of any kind.

I do not refer to these experimental results with any great confidence that they represent the specific lesions which result from specific dietary defects. We are still occupied with the study of how to prepare an optimal diet. It is not certain that we know of all the vitamins which exist. There are factors in the diets used in the study of Dr. Grieves which were either not adequately defined, or were perhaps entirely unappreciated. It is too early in dental research as related to diet to attempt to speak with finality on any point. The one thing which is obvious is that the diets of our rats influenced in a profound manner the quality of the teeth and their susceptibility to disease.

The incisors of a healthy rat are so firmly inserted that they cannot be extracted by means of the strongest tweezers in an ordinary dissecting set. We have observed many rats, however,

1. Grieves, C. J., et al.: Bull. Johns Hopkins Hosp., 33: 202 (June) 1922.

during our studies on the effects of defective diets on modifying bone growth, whose incisors were withdrawn from their sockets as easily as a sliver of wood from a piece of cheese. In some animals, the incisors were very soft and chalky, the condition leading either to fractures or to wearing away of the tooth to the gum line. To a lesser degree, the molars have also been modified to an extent which was easily apparent even to one untrained in observing the teeth.

It is well demonstrated that certain types of faulty diet, involving unfavorable intake of calcium and phosphorus and a deficiency of the antirachitic vitamin D, cause marked changes in the anatomic structure, which can readily be seen under magnifications of five or ten times. Profound changes take place in the bones in scurvy, a disease due specifically to a lack of vitamin C. The bones become rarefied. The spongy bone supporting the teeth becomes so far resorbed that the teeth loosen and, in extreme cases, fall out. On provision of the missing vitamin, the tissues are recalcified so as to afford support again for the teeth. This is observed in human subjects as well as in animals.

Hypoplasia of the enamel of the teeth of swine is of fairly common occurrence in young animals which are stunted from faulty feeding. This was formerly seen not infrequently in the corn belt of the Middle West. Hypoplasia of the enamel likewise occurs in certain children. It occurs in the teeth of certain experimental rats. There seems to be little doubt that it is the result of malnutrition at a critical time during the formation of the teeth. Whether there are other possible causes which have no nutritional element I do not know.

I have been assured by a number of dentists that teeth of the best quality have a yellowish tint. They state that white or bluish teeth are not likely to have the resistance to unfavorable agencies from without which these yellowish teeth have. The color of the teeth in the rat may be markedly influenced by diet. From the anterior aspect, the incisors are normally a bright orange. By the addition of fluorin to the diet in an amount (120 parts per million) which still permits the animals to grow in a fairly normal manner and reproduce and rear young, the color of the incisors in great measure fades. I am not suggesting the cause of freedom of teeth from pigmentation, but only illustrating an instance in animals in which it has occurred as the result of unfavorably modifying the diet. We are concerned here only with fundamental principles, and only remotely with their possible application in human experience.

It is well known that a severe metabolic disturbance such as high fever may interfere with the growth of the nails, so that an area of hypoplasia appears later. This gradually moves outward as the nail grows. It has been noted in wool investigations that if sheep are subjected to a period of semi-starvation or of exposure to storm, there will be a weak spot in the wool fiber marking the point at which growth was interfered with. These are examples of severe impairment of bodily function causing a structural defect in a tissue which can be readily observed. The fact that outstanding deviations from the normal appearance in incisors, which grow throughout life in rodents, and

in the molars in the same species, which are finished by about the sixtieth day from birth, under conditions in which no factor can possibly be responsible other than faulty nutrition, is strong evidence in support of the view that the structure of the enamel and perhaps other dental tissues may be defective from this cause to a degree that renders the teeth vulnerable to the agencies causing disease.

Anyone who is familiar with the steel-faced plow employed to turn over the soil knows how important it is that the mold board be highly polished. Even the superficial pitting which results from leaving the mold board exposed to rain for two days is sufficient to cause the soil to adhere firmly to the surface when the plow is used again. When the surface is polished like a mirror, the soil slips off easily and with little friction, no matter how dry or how moist it may be. Isn't this an example of what happens in the case of a tooth whose enamel rods are not finished to the perfection seen in the best of teeth? Excellent teeth probably have, like perfect crystals, surfaces which are smooth to a degree approaching molecular dimensions. Less perfect teeth may be smooth on the surface as far as the most careful inspection can show; yet the surfaces may be rough enough to facilitate the adherence of food particles to them to an extent quite sufficient to undermine their resistance to decay. Imperfections of surface may be only localized, and be extremely small, yet their existence may be fatal to the lasting qualities of teeth. For several years, physicists were unable to understand why roentgen rays could not be reflected when in other respects their nature presented so many analogies to light. It was ultimately discovered that ordinary mirrors of the highest grades are not smooth enough to reflect these rays which are very short wave lengths. Suitable mirrors for roentgen rays were found in the surfaces of crystals, the smoothness of which lies within the molecular dimensions of the substances forming the crystals. Very little things have been found in several departments of knowledge to be of striking significance.

Returning to the possible relation of the nutritional factor to dental diseases: We must take into account the influence of the nutritive condition of the body on the composition of the digestive secretions. It is well known that the composition of the gastric juice with respect to both acid and pepsin differs very widely in different individuals and in the same person at different times. Similar differences have been shown for other digestive fluids. The secretion of the salivary glands is not uniform with respect to amylase or mucinous protein. What reason have we for assuming that it is constant as respects other constituents? None, except that we have no methods for demonstrating other significant differences. A few years ago, we had no methods for demonstrating that the content of the waste products of the body, i. e., the normal constituents of urine, varied significantly in the blood. Now biochemists have perfected methods of blood which show clearly that there are significant accumulations of these in the body fluids, notwithstanding they appear very small in terms of ordinary units of measurement. They are adequate for doing great harm. It has not been demonstrated that abnormal composition of the saliva in certain individuals does not exist, and it may be

well that, in certain mouths, the fluid secreted by the salivary glands is an unsatisfactory medium for tooth preservation.

In this connection we should consider also the disturbance of digestion in the stomach and intestine, which causes more or less distress, and leads to a return of some of the content of the stomach or intestine, or both, toward the mouth. This subject has been investigated by several able workers, and the results seem to establish that the return of material from below to the mouth is very appreciable, and may do persistent damage to the teeth, especially during sleep. Patients who, because of a heart lesion, persistently sleep on one side are said to suffer more from tooth decay on the side which is uppermost during sleep. This is referred to the dryness of the teeth on this side of the mouth. More accurately, it may be described as a stagnation of the fluids on the surface of these teeth. This shows how important is the environment of the teeth as regards their resistance to decay.

I would not attempt to minimize the importance of the bacteriologic factor in including dental disease, for the evidence seems overwhelmingly in support of it. Mouth hygiene is just as important as it has been heralded to be by even its most enthusiastic supporters. Dentists have told me repeatedly that the teeth continue to decay in many mouths kept as clean as more than ordinary care can make them. There must be factors other than the bacteriologic involved. Reference to indefinite endocrinologic explanations of dental disease is to little purpose because the etiology of endocrine disturbances is still too uncertain except within very limited spheres.

I have been telling my dentist friends for several years that I believe that certain of the most fundamental problems of the possible importance of the developmental factor, as well as the environmental, in relation to dental disease, can be solved by a suitable investment in animal research. For this purpose, it is necessary to employ large animals, such as swine, which have a long gestation period, and to apply in the planning of their diets all the knowledge that we now possess as to how the structure of the bones can be modified by faulty nutrition. The effects should be secured during the prenatal period alone, during the suckling period alone and during the period after weaning, to determine when in early life the young pig is most susceptible to injury. Such a research is contemplated, and indeed the initial steps have been taken. I regard such an investigation as one of the most fundamental which could be undertaken.

In the meantime, while we are waiting for animal experimentation to answer the questions which are now so much discussed in dental circles, viz., the relative importance of structure and perfection of quality in the teeth, the developmental factors, and of the environmental, bacteriologic, factors, we are now in a position to gain very important information on human subjects. This it is far more difficult to secure in a convincing form, since there are many conditions of life in human subjects which we cannot control with the necessary thoroughness except under very favorable circumstances. Every dentist should familarize himself with the results of modern researches in nutrition, and should advise his patients how to plan their diets. If dentists would undertake to impress on the mind

of every expectant mother the significance to herself and to her child of adhering carefully to a well-planned dietary regimen, and to proper feeding of the infant from birth, we should, within a few years, have a large number of children whose mouths would tell us very definitely whether we are right or wrong in our beliefs in one or another program for preventing dental disease. Several dentists have told me recently that they see the good effects in the children whose parents are intelligent and conscientious in applying the modern science of nutrition in feeding children. We need a more systematic effort by dentists to extend this idea, so that, ten years hence, we may have a sufficient number of carefully observed children whose dietary history is well known enough to permit of definite conclusions as to what we really know and what we merely think we know about the importance of diet in a program of preventive dentistry.

There is another line of attacking this subject which promises good results. The study of a community over a series of years in order to obtain full and accurate medical, dental, hygienic and nutritional histories of all the families, supplemented by sound medical advice, counsel from a highly capable visiting nurse, health education in the schools, etc., should, if we are sound in our conclusions, show progressive improvement of the teeth of the children as time passes. Such a study of a community has been in progress under the auspices of the Merrill-Palmer School of Detroit for more than two years. We may expect the first report of this study during the present year. It is believed by those who are closely identified with the enterprise that it has been more thoroughly conducted, and with more effective cooperation from parents and children, than any similar undertaking. It is hoped to continue the study of this intelligent community for many years, and among the things which are to be learned by it are answers to the most important question before the dental profession, the prevention of dental disease.

It would be out of place here to give in detail the advice on diet with which the dentist should be familiar. Dr. Simmonds and I have discussed elsewhere[2] the application of the known scientific facts about foods and the nutritive requirements of the body to the planning of the daily diet. The subject no longer needs justification. Modern research in this field has brought to light so many new and surprising facts that the subject is full of romance. Fortunately, there is no hardship in right eating.

DISCUSSION

A. LeRoy Johnson, Philadelphia, Pa.: I am sure that you do not expect me to discuss the scientific phases of Dr. McCollum's paper. There are but few men in the country qualified to do so, and I am not one of them. It is pure assumption for the clinician to pose as a critic of the methods and findings of the professional research worker. Scientific investigation is today carried on by those especially trained in special fields amid surroundings where organization of resources, material and intellectual, is possible. The scientist in the laboratory and the clinician with the patient have definite places in the social scheme. Neither is qualified to do the work of the other. Nor is either self-sufficient. It is from the cooperative efforts of the two groups of workers that the public benefits most. We do not question the findings of the scientist in the laboratory; our concern is the relation of his findings to our

2. McCollum, E. V. and Simmonds, Nina: Food, Nutrition and Health, published by the authors, Baltimore, Md.

problems in dentistry. Dentistry is particularly indebted to Dr. McCollum and his coworkers. The contributions which they are making are having a profound influence on dental education. In this country, dentistry has evolved as an independent system of education, and this independence has contributed to the high degree of technical skill that characterizes the American dentist. But recent advances in biologic sciences, notably in the field of dietetics, have made this independence of dentistry a liability far outweighing any advantage it may have been in years past. Dr. McCollum's paper shows clearly that many of our problems in dentistry are not local in the sense of origin, but instead are local manifestations of general conditions. Therefore, dentistry must look beyond the teeth in the study of its problems. Though limited by law to treat but a certain region of human anatomy, we are free to carry our concepts to the boundaries of the organism; we are compelled to extend our vision and become, in fact, specialists in the field of medicine. At the present time, in our dental schools, there is a tremendous hiatus between the fundamental sciences and the clinical subjects. There is nothing that will do more to correct this condition than the work Dr. McCollum is doing. It has been a distinct loss to dentistry that Dr. Grieves has been unable to continue his work. He was a vital force in uniting the two professions of medicine and dentistry. The attitude of Dr. McCollum in regard to the significance of his work is a splendid example of the spirit of the scientist. He says, "It is too early in dental research as related to diet to attempt to speak with finality on any point." In no instance is he dogmatic. We might with profit adopt more of the same spirit in dentistry. Misinterpretation and misapplication of his work is a source of annoyance to an investigator. In our profession there are men who profess to believe that in prescribing a certan diet for the human being, they can anticipate results with the same degree of certainty that the investigator can in his studies on rats, guinea-pigs and monkeys. There are others who would discredit the results of all scientific investigation on the lower animals. Because they cannot obtain the same results in all human beings that the investigator does in animals, they dismiss the subject with the belief that the data of the scientific laboratory are not applicable to the human being. Such extreme views are not only untenable: they reflect an attitude of mind that makes progress slow, and cooperation between the research worker and dentist difficult indeed. There is no doubt that animal experimentation gives us the rational leads to the dietary characteristics of the human being. The fact that the human individual does not react in so specific a way to a special diet as the albino rat does not mean that knowledge derived from the study of rats is of no value in the study of the human being. We should not expect the human being to react so specifically. Dr. McCollum calls attention to the hereditary constitution of his animals, and his control of environmental conditions. He shows how essential this is in determining the effect of different diets. In contrast, the human being presents a most involved hereditary complex. And as development is inevitably the result of the interaction of the hereditary and environmental factors, we cannot expect to anticipate the results of dietary influence on the human being with the same degree of certainty that the investigator can with the laboratory animals. Dr. McCollum asks us to make systematic studies of the diets of our patients. I believe that, wherever it is possible, the study of identical twins (so-called) will yield the most valuable material. In these cases, we have two individuals with more nearly the same hereditary constitution and a more nearly uniform environment, at least to the time of birth, than is the case in other individuals. The compilation of the histories of identical twins relative to dietary habits is an investigation that some one can well afford to carry on. We should remember that the human being is a more highly organized, complex mechanism than the laboratory animal, and this increased complexity is another reason why the reactions to environmental conditions are not so predictable. In our every-day life, we are bombarded continually with sensations; preceptions and conceptions that condition our digestive processes. By taking thought, a man may not add one cubit to his statue, but he can ruin his digestion. Pawlow, in his work on the digestive glands, shows that the presence of food in the stomach is not the prime condition of gastric secretion but that it is a true psychic secretion. "The mere sight or smell of a favorite food may start

the pouring out of gastric juice, as was noted many years ago by Bidder and Schmidt in a hungry dog which had a fistulous opening through the body wall into the stomach." Cannon says the stomach "waters" as well as the mouth in preparation for digesting the food. The proper starting of the digestive process is conditioned by psychic states; the satisfactions of the palate, and the consequent flow of the first digestive fluids. Thus it is not enough that the essential food elements: vitamins, proteins, carbohydrates, fats, inorganic substances, etc., are available in the diet. If the digestive process is to proceed in the best possible way, and the desired results are to be obtained, food must be presented in such form that it will appeal to the imagination of the child, and, which is very important, food must be taken under peaceful conditions. Forcing a child to eat something that it does not like is hardly conducive to normal processes. The scientific laboratory shows us what the essential food elements are. Adapting these food elements to the idiosyncracies, psychic as well as physical, of the human individual and endeavoring to ascertain the effect on dental structures is our field of work. It seems to me that the statement by Dr. McCollum that "the position of the teeth is important in influencing their resistance to decay" and the idea which he presents relative to the physical character of the outer surface of the enamel may refer to the same group of phenomena. I believe this to be true if we interpret the phrase "position of the teeth" to signify the relations they bear to each other during the whole process of dentition. Evidence is accumulating which seems to show that even slight impactions of the teeth during eruptive periods influences the structure of enamel. As regards the positions which teeth occupy: it is a matter of common observation that those which do not function in occlusion are liable to degenerative changes. But the old idea that irregularities in alinement predispose to caries I believe has been given undue emphasis. While tooth alinement is undoubtedly a factor in oral prophylaxis, and so is of importance in oral pathology, its relation to the particular condition that we know as dental caries is the question I raise. Clinical observations so often contradict this idea that I feel justified in asking Dr. McCollum to amplify this point. I am glad that Dr. McCollum has called your attention to the activities at the Merrill-Palmer school of Detroit. At this institution, Dr. Samuel Lewis is making models and very comprehensive dental records once a year of selected groups of children; i.e., at the end of ten years, he will have ten models and other dental records of each child in the group. So in addition to the data bearing on the prevention of dental caries referred to by Dr. McCollum, evidence relative to normal processes of development of the face and jaws will be available. The children of whom series of models are being made are not receiving orthodontic treatment; hence, the changes recorded in the models are indicative of natural developmental processes. In correlating the conditions shown in these models with records of diet; general orthopedic charts; habits; mental and physical tests, all of which are available, data will come from this institution of great significance to dentistry.

O. H. Gaver, Baltimore, Md.: I agree with Dr. McCollum that Dental Research has not reached the point where we can deal with causes and effects with any degree of finality in relation to diet and dentistry. Yet, we do know that the resistance of the tooth to bacterial invasion depends on the structure of the teeth, the susceptibility being increased or decreased to a great extent by its environment. I do not believe that the teeth must possess surfaces so smooth as inferred in order to insure immunity to decay, as the excursion of the food over such surfaces will prevent the retention of food particles which might undermine their resistance. Of course, such a condition might present itself in the interproximal surfaces, through decomposition or putrefaction, if food were allowed to remain there for any length of time, regardless of the perfection of the surfaces. The character and amount of saliva that bathes the teeth undoubtedly influence the resistance. We are all familiar with the condition of teeth in a mouth in which the saliva is of a ropy and mucilagenous character owing to the overactivity of the submaxillary and possibly the sublingual glands. The mucin, which is the principal constituent of such a saliva, forms plaques which it is difficult to remove, and offers a favorable seat for bacterial activity. Such a condition is an exception rather than the rule. Just how prevalent decay is in teeth which are

uppermost when people persistently sleep on one side is a matter of conjecture; for, during sleep, all secretions are materially reduced, yet, even in this position, the teeth should be bathed in a small amount of saliva because of the location of the salivary ducts. If such were the case, those individuals sleeping on their backs would expose all the teeth to the ravages of bacteria. I am of the opinion that caries is due primarily to nutritional deficiencies, producing the initial lesion, and to bacterial invasion secondarily. As referred to in the paper, this deficiency may be operating during prenatal life and infancy, and even later in life. Just what forces are concerned in producing and maintaining perfect teeth is still a debatable question; yet Dr. McCollum has proved by experiments that the quality of the teeth can be altered by feeding a diet deficient in calcium salts or certain of the vitamins. Is it not possible that, if once the calcium salts are absorbed in sufficient amounts to meet body requirements, with a deficiency of vitamins they are not properly metabolized and are necessarily eliminated from the body in a similar manner as the carbohydrates are when there is an impairment in the functional activity of the islands of Langerhans, which secrete an internal secretion, and manifesting itself as diabetes mellitus? Physiologists for a long time were unable to explain the metabolism of carbohydrates, but we now know that the dextrose is not utilized by the tissues as such but the molecule undergoes a series of preliminary changes, as the formation of glyceric aldehyd or methyl-glyoxal or both, and then changes to lactic acid, with the final products of carbon dioxid and water. While we do not understand the physiologic changes and reactions that calcium undergoes before it is finally utilized by the body, which may or may not be a true chemical combination with the organic material as the iron in hemoglobin, it evidently is influenced by the vitamins either through direct action or by acting as hormones in stimulating the parathyroids and possibly the pituitary body. If there is any interference with these forces, whatever they may be, the deficiency of calcium is met by calling on the structures containing it in large quantities. All types of deficiencies of the body are met in a similar manner, as, for instance, in starvation, the proteins of the blood are maintained at the expense of cell protoplasm, the heart, brain and lungs not being excepted in extreme cases. We all know that, as stated, the teeth of some people decay in spite of unusual prophylactic measures. Surely, we cannot attribute this to decomposition products undermining the resistance. I might also refer to the white areas appearing on the labial and buccal surfaces of the teeth from time to time in a mouth in unusual hygienic condition. Might we not conclude that the resistance has been reduced from within out rather than from without in? Dr. McCollum has already proved by experiments that the supporting structures of the teeth undergo marked changes when an animal is fed a diet deficient in the antirachitic vitamin D with an unfavorable intake of calcium, and when these deficiencies are corrected, the structures again become normal. Also the bones supporting the teeth become rarefied during scurvy, but are again recalcified on addition of the vitamin C. We likewise know that the inorganic material of the tooth can be increased, as in the case of pulp stones. A similar condition also manifests itself in the deposition of secondary dentin as the pulp recedes, which may continue to such an extent as totally to obliterate the pulp chamber and, in extreme cases, the entire canal, which is not necessarily due to irritation. We know that there is circulation in the dentin, whether capillary or diffuse, as was demonstrated by Gies, who injected dogs interperitoneally with trypan blue and found the stain was carried through the dentin and, in some places, into the enamel, which, at a later examination, was found to be removed. Dr. Howe reports that lead was found, by a spectrum analysis, in the tooth structure of a patient suffering from lead poisoning. Aub concludes that the lead took the place of calcium and was laid down as a phosphate. Knowing that the supporting osseous structure of the teeth can be decalcified by certain types of diets and again recalcified on correction, and that the blood has the power of depositing additional inorganic material in the tooth, might we not assume that it is entirely possible for the blood to remove the inorganic material, calcium not excepted, in a like manner, thereby reducing its immunity and resistance to bacterial invasion and producing decay?

PREVENTIVE DENTISTRY AND BEDSIDE SERVICE IN HOSPITAL PRACTICE

By S. Z. SOSTRIN, D.D.S., Chicago, Illinois

THE aim of all dental service in our public institutions is not merely to relieve suffering and attend to emergency work but also to inculcate the lesson of prevention through instruction to every patient coming under the service. This may be done to better advantage at this time than under ordinary circumstances. The person who is ill in a hospital is more amenable to advice on health matters than is one who is going about the usual affairs of life.

It is really a blessing that, for those who find themselves incapable of engaging a dentist, there has been provided the dental clinic. Nearly every hospital has a dental department fully equipped for the use of its patients. The Michael Reese Hospital in Chicago furnishes dental treatment to the general ward where treatment is given gratis.

To these general wards, a man who is poor, his family or children, may go and get medical treatment. If, in addition, he is suffering from dental disease in any of its manifestations, the services of the dental department are available to him. It is generally separate; and he makes use of it when he is aware of its utility, and when his condition does not prevent him from making his way to it. But there are usually reasons of one kind or another which prevent him from making full use of the dental department. It is not always the patient's fault that this is so, though his ignorance of dental hygiene and of its value in conserving health often renders the work of the dental department ineffective. The fault seems to lie rather in the lack of elasticity of a system whereby the dental department is kept separate from the routine of medical treatment. True it is always called on in cases of cogent need, but it is not allowed to function as an organic and essential element in aiding to restore the patient to health.

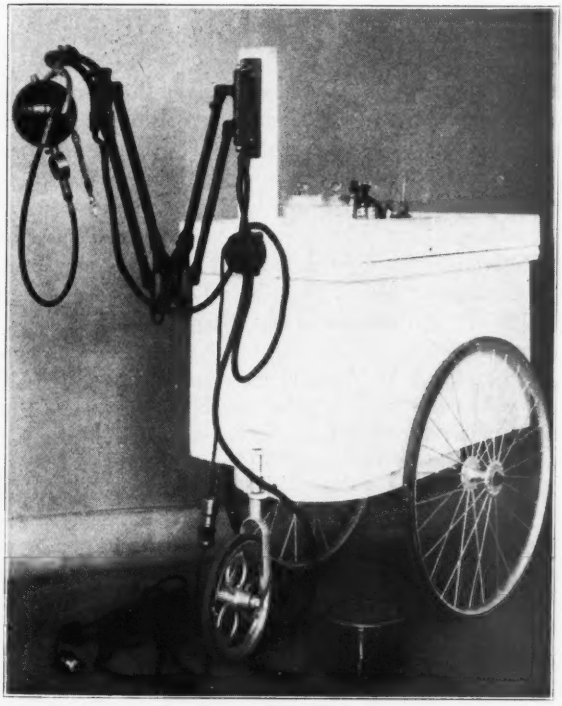
This is not to be taken as a criticism of the dental department nor of its functions in the modern hospital system. The work it does is of immense value; but it does not do enough of it, owing, perhaps, to the fact that it is in its embryonic stage of development. The number of patients ordinarily treated by a hospital dental department number about twenty out of every hundred. The rest often lie in bed with neglected teeth, diseased mouths and enough low grade infection to retard, more or less seriously, the progress toward recovery.

This very pointedly brings up one of the most important questions bearing on the development of dental therapeutics. Is the dentist to remain in his present status, his service an important adjunct, but still an adjunct, of the science of medicine; or is he to step into his rightful place beside the physician and render him valuable aid in

the treatment of many serious conditions?

There seems to be little doubt that the answer to these questions is to be found in the increasing realization of the importance of focal infection and in the fact that one of the two principal seats of focal infection is the oral cavity. Here, in broken down and infected teeth, pyorrhea and other disorders, is hidden (for they are rarely painful) the origin of many serious diseases. A vast and hitherto unsuspected field in medical diagnosis has been thrown open by these discoveries, and research is constantly widening the vista. The most moderate attitude that can be taken, in the light of these revelations, is that the condition of many patients calls for thorough prophylaxis.

The introduction of such treatment has been delayed by what were once thought to be insuperable objections. One of these was to the effect that most patients are ignorant of the value of dental treatment and are likely to desire it least when they are in need of it most. Another was that it was impossible to move a patient if his condition chanced to be serious or if he had



Hospital Dental Cart.

been recently subjected to surgical operation. Now these are valid objections, but, as was said before, they are not insurmountable.

To the contrary, they all combine in the need of a new approach, a readjustment to the demands of modern therapeutic doctrine on the part of the dentists. At Michael Reese Hospital, this readjustment has been made. The dentists determined to treat the patient in his bed. But here a new obstacle interposed; so far as was known, no apparatus designed for this sort of use could be bought in the open market. So they constructed one themselves.

An ordinary hospital cart was fitted with a post, made to extend about one foot above its level, and to this post was attached a regular dental engine. A shelf was made to fit the top of the cart and designed to hold the dental instruments and sundries. Here was all the mechanism needed for the new work, and it possessed the two qualities essential in such a device, namely, mobility, and the need of little effort to propel it. With this improvised dental fixture, the dentist may clean the teeth, put in temporary fillings and give such other treatment as is indicated by the condition of the patient. And he may do all this without moving the patient.

Shortly after the patient is admitted to the general ward, the dentist or his assistant wheels the dental cart to his bed. With the aid of his new appliance, he scales and polishes all the patient's teeth, and it is decided what dental work is needed to aid the patient in regaining his health. If it is practicable to move the patient, the necessary work is done in the dental department, where extractions and other work are performed; but when extraction or filling is deemed important, and it so happens that the patient may not be moved, the work is done at the bedside. Every effort is made to eliminate focal infection and, when found, efforts for its eradication are immediately started. This plan is also used and can be practiced on private patients.

An integral part of this plan is the instilling into the mind of the patient the importance of the principles of dental hygiene. Throughout the period of his treatment, he is instructed by the dentist in the proper care of the teeth and is told why it is that the periodical visit to the dentist is so very important, that such visits, if only for the purpose of having the teeth cleaned, enable the dentist to check at its inception any pathologic condition, thus fulfilling the highest principle of preventive dentistry. It is also conveyed to him that he must brush the teeth twice each day in order to keep them clean and free from deposits.

At this time, the nurse steps in and aids the dentist in the education of the patient. She is fitted for this work by lectures given her in her student course on the fundamentals of dental pathology, i. e., pyorrhea, decay, abscesses, and their causes and effects, and also on preventive dentistry. As a result of this training, she thoroughly understands the part played by dental hygiene in hospital cases. She provides the patient with dentifrice and a toothbrush and sees that these are properly used. Sometimes, it happens that a patient is unable to use his arms or is otherwise prevented from brushing his teeth. In such an emergency, the nurse performs that office for him. She often must do

this for children, many of whom are entirely lacking in knowledge of what a toothbrush is supposed to be, and what use it should be put to.

The benefits accruing to the patient under this system of bedside preventive dentistry and dental hygiene are obvious. An examination of the patient's mouth often discloses one and sometimes several serious dental diseases. Of course, the dentist then explains to him the part played by such disorders in undermining his health and what he should do to obviate them in the future.

There are times when the condition of a patient's mouth has no serious bearing upon his illness, and, when this is so, he is given only such temporary treatment as is necessary; but, at all times, the teeth are cleaned and a lesson on preventive dentistry is given the patient. The permanent work to be done is completed elsewhere after his discharge from the hospital.

ONE HUNDRED PER CENT DENTAL CORRECTIONS IN ATHENS

By N. G. SLAUGHTER, D.D.S., Athens, Georgia

Let it be known to all men that the Georgia State Dental Society, in pursuance of its high mission to promote happiness and efficiency of the people through dental health, has bestowed upon the Corporation of the City of Athens, Georgia, this certificate of Distinguished Service for the perfect work in the dental health of its school children. In testimony whereof we have hereunto affixed our signatures and seal this 10th day of May in the year of our Lord Nineteen Hundred Twenty-seven.

(Signed)

DR. F. C. WILSON, *President.*
DR. G. A. MITCHELL, *Secretary.*

THIS certificate, presented by Dr. Wilson to the mayor of Athens at the May Day child health celebration, marks an achievement of which this city of 20,000 is justly proud. Every child in the four white elementary schools, and the junior high school has been given a dental examination. Every child needing dental treatment has received it. All defects except malocclusion were included in the reckoning. This was omitted because of the length of time necessary to secure corrections. One hundred per cent dental corrections have become a reality.

Four years of mounting professional interest in preventive dentistry for children, and a fine spirit of cooperation which put the community squarely back of the dentists, are responsible for this record, which, of course, Athens hopes to duplicate year by year. It is the fruit of joint effort in which the board of education, with the school principals and teachers, the board of health, the parent-teacher association, the Clarke County-Athens Child Health Demonstration (financed by the Commonwealth Fund) and the dentists all had a share.

The beginning of this splendid program probably dates back to the session of the Georgia State Dental Society held in Athens in 1923. DeLos L.

Hill, chairman of the program committee, arranged a meeting dealing exclusively with preventive dentistry. Percy R. Howe of the Forsyth Dental Infirmary, Otto U. King, Secretary of the American Dental Association, Willis A. Sutton, superintendent of schools of Atlanta, Ga., Miss Gladys Eyrich, supervisor of the division of mouth hygiene of the State of Mississippi, and others were on the program. The interest which followed this meeting lay dormant until 1925, when at a meeting of the Eighth District Dental Society, the Child Health Demonstration committee most generously consented to give the city of Athens, for a demonstration period, the service of a dental hygienist. A well-qualified worker was employed and made a member of the school faculty, and the goal of 100 per cent dental corrections began to be talked of.

In the summer of 1926, the Child Health Demonstration committee offered to bring to Athens, for the session of the Eighth District Dental Society, one of the best available men to present dentistry for children, and Harold DeWitt Cross of the Forsyth Dental Infirmary of Boston was accordingly secured. Dr. Cross demonstrated methods for the treatment of pits and fissures, and other speakers dealt with orthodontia and the rôle of nutrition in the formation of teeth. A public meeting under the auspices of the parent-teacher association was also arranged in connection with the society's meeting, and Professor Sutton gave an inspiring address to a large audience of parents and teachers.

Parents, teachers and dentists had now caught the vision, and a united campaign for the improvement of dental health began. The board of education offered a special holiday to any classroom in which all the children were free from dental handicaps. Oconee Street School, in the millworker's district, led the way, and the whole school celebrated its holiday before Christmas. The four other schools reached their goal by May. School teachers worked diligently, not only with their pupils in the classroom, but with parents as well, and the parent-teacher association gave valiant aid in the trying cases in which parental indifference was the greatest obstacle. The dental hygienist stimulated interest throughout the schools, examined teeth and, with the dentists' approval, gave prophylactic treatment.

The question of finance is always a serious one in public health. Every child was expected to pay for the services rendered, and, of course, Athens, like every other community, has its poor. The dentists, with the great goal of service to all children uppermost in their minds, reduced their charges wherever the need was evident and gave free service to children known to be indigent. At the Oconee Street School, the handicap of small family incomes was ingeniously met by the teachers, who organized a revolving loan fund from which the necessary costs of dental work were paid in full, after which the child's family repaid the loan, little by little.

In addition to meeting the special needs of those unable to pay the full cost of their work, the dentists cooperated by signing a simple record card when the work a child needed had been completed. These cards, in many cases,

were posted in the schoolroom as an informal honor roll.

The total number of children in the white elementary schools examined during the school year was 1,494. Of these, 608, approximately 40 per cent, were found to need dental treatment, and all of them secured it.

In addition, 573 children were given prophylactic treatment by the oral hygienist.

Special effort was likewise made with the children in the three colored schools of the city. Regular school attendance of this group is a thing not heard of, and it was quite impossible to trace children through the fields, where they labored to eke out the family income. However, one colored principal reported 85 per cent corrections among the children that were constant in their attendance, and reports from the two other schools show that a very good beginning has been made with the colored child.

Two facts stand out prominently: but for organized dentistry, this great service could not have been rendered, and the city as a whole was roused to a pitch of interest in dental health which it had never before reached. An amusing illustration of the impression made on the children came to light in one of the schools when a distinguished visitor from Oxford, England, was introduced. He asked what Athens was noted for. Two hands went up, and the reply was, "100 per cent good teeth;" this in spite of the fact that Athens is the home of the University of Georgia, the state college of agriculture and the state normal school, and the former home of great Georgians such as Crawford W. Long, Ben Hill, and Henry W. Grady, who died "loving a nation into peace."

The steps taken may be summarized as follows:

1. Public meetings were held to arouse interest among children, teachers and parents in the importance of a clean, healthy mouth as regards the child's development.

2. A tangible reward was offered as an inducement to the child to secure needed care. A special holiday was used in Athens; ribbons, buttons, etc., have been used for similar purposes elsewhere.

3. Arrangements were made with dentists for the care of those dependent or semidependent.

4. Teeth were examined by the dental hygienist, and parents were notified when dental treatment was found to be needed.

5. Visiting nurses, teachers or committees from the parent-teacher association followed up these notifications in the home.

6. Cards on which the dentist had certified that corrections had been made were posted in the schoolroom, as a spur to children who were procrastinating.

7. The children, anxiously awaiting their holiday, brought pressure on their parents and on each other.

8. Loan funds were developed to provide immediate treatment for those able to pay only in small amounts.

The question you may ask is "Is it worth while?" Try it out in your own town or city. You will get the greatest thrill of your life. If you are not interested in children when you begin you will be when the work is finished. "Inasmuch as ye did it unto the least of these, ye did it unto me."

ALL DENTAL DEFECTS CORRECTED

Every white child in the public schools of Athens, Ga., has obtained a certificate from a dentist stating that all necessary dental work has been completed. The city health commissioner and the director of the Athens Child Health Demonstration state that Athens is one of the first cities to achieve this record. The campaign has progressed to completion since about January 1, following a conference of the departments of health and education and the dentists. There were talks and the distribution of literature in the schools, clubs and churches. The results are attributable, however, largely to the efforts of the school teachers and the cooperation of others concerned. The dentists did much work without charge. Frank C. Wilson, D.D.S., president, Georgia State Dental Society, presented the mayor of Athens with a certificate commemorating the achievement.—*J.A.M.A.*, May 28, 1927.

A NEW TOOTHBRUSH

Any community wishing to obtain toothbrushes to be distributed among the school children at a reasonable price will be interested in the new brush developed by the Minnesota State Dental Association through its oral hygiene committee. Brushes sell for 10 cents each, plus the postage, in lots of one dozen or any multiple thereof. They can be obtained through Dr. F. Denton White, chairman of the Oral Hygiene Committee, 307 Masonic Temple, Minneapolis, Minn.

CLEVELAND'S MOUTH HYGIENE STAFF

Sixty-nine persons are devoting their entire time to the mouth hygiene movement in Cleveland; 22 dentists spend their time with 6-year-old children; 17 dental hygienists teach the children from kindergarten to the sixth grade to use a toothbrush and how to use it, and also encourage the use of milk, green leafy vegetables, fresh fruits and other vegetables, as a proper diet; 22 mouth hygiene assistants act as clerks and helpers for the dentists and hygienists; 2 dentists and 3 assistants annually examine 85,000 to 90,000 children; 2 secretaries care for the office routine of records, etc., and the remaining one person tries to keep the staff working happily and efficiently.—Harris R. C. Wilson, in *Am. J. Pub. Health*, June, 1927.

SCHOOL DENTAL HYGIENE WORK IN BRIDGEPORT

Bridgeport, Conn., has carried on school dental hygiene work for ten years. Recently, a dental survey was made of 24,000 children from the kindergarten to the eighth grade in its public and parochial schools. Comparing the results with those of the examination of 1,000 children in another community of the same state where no school dental hygiene work has been done, it was found that 8 per cent of the children of the other community had no fillings and no cavities. Findings for the sixteen racial groups among the Bridgeport children showed very little difference that could be attributed to nativity, but children from sections of the city where the standard of living is high had the better teeth.—*Bull. United States Department of Labor.*

FIELD NOTES

Miss Margaret Bailey, formerly school hygienist in McComb, Miss., has recently been appointed as director of the School for Oral Hygienists, Temple University, a position formerly held by Dr. Helen Beck.

Three dental hygienists have recently been appointed by the American Child Health Association to work with the three health units which will begin work in the fall and will cover the United States. The hygienists are Margaret Maguire, Boston, Mass., Phyllis Quinby, Boston, Mass., and Sadie Abrich, Newark, N. J.

Dr. Lon W. Morrey, formerly of Lake Forest, Ill., is now superintendent of mouth hygiene of the Department of Public Health of Illinois, filling the position formerly occupied by Dr. H. L. Freidinger.

Medical and Dental News

Arkansas

Dr. Travis on Examining Board: Floyd P. Travis of Osceola has been appointed as a member of the Arkansas State Board of Dental Examiners, to succeed G. C. Jernigan of Rector.

Georgia

Dr. Donaldson Director of Hygiene: John B. Donaldson, of Dublin, has been elected director of oral hygiene in the public schools of Atlanta.

Illinois

Dr. Morrey Appointed to State Position: Lon W. Morrey, for three years school dentist in Lake Forest, has been appointed state superintendent of oral hygiene. He entered on his new duties September 19.

Northern Illinois Dental Society Meets: The forty-second annual meeting of the Northern Illinois Dental Society was held in Aurora, October 12-13. E. H. Smith presented a paper on "Mouth Hygiene and Its Effect on School Progress," at the first morning session. A memorial service for Drs. Edmund Noyes and A. N. Stone was held, M. L. Hanaford, of Rockford, presenting the eulogy. At the afternoon session, G. R. Lundquist, Chicago, presented a paper on "A Consideration of the Various Control Methods Used in the Treatment of Pyorrhea," and Stanley W. Clark, Chicago, spoke on "Mouth Infections and Their Treatment as Ordinarily Encountered by the Practicing Dentist Previous to and Following the Extraction of Teeth." The general session was addressed by Dr. David Kinley, president of the University of Illinois. The second day was given over to a comprehensive program of clinics.

Indiana

Northern Indiana Society Meets: The thirty-eighth annual meeting of the Northern Indiana Dental Society was held in Elkhart, September 26-27. At a lecture given in the morning of the first day, on "Tuberculosis," by Eric A. Crull, M.D., of Fort Wayne, the medical profession were guests. F. C. Hughes, of Indianapolis, gave a lecture on "Full Denture Construction,"" and J. L. Wilson, of Indianapolis, spoke on "Root-Canal Operations."

Minnesota

Dr. Hill to Abbott Laboratories: Lawrence E. Hill, formerly director of the dental clinic of the Rochester public schools and the dental department of the state hospital at Rochester, is to have charge of the work in dental research and clinical investigation at the Abbott Laboratories, North Chicago, Ill.

Ohio

Dr. Jones Appointed to Health Board: W. I. Jones, of Columbus, has been appointed by the governor to serve on the state board of health. Ohio is the fifteenth state to appoint a dentist to a position on the state board of health.

Virginia

Course for Dental Assistants: In the school of dentistry of the Medical College of Virginia, Richmond, a new course for dental assistants has been inaugurated this year. Applicants for admission must meet college entrance requirements and spend one year in residence. This course is designed to equip young women to assist the dentist in the usual office and in certain laboratory routine. It is not a course for dental hygienists.

Foreign

Work Begun on Eastman Dental Clinic: The site for the Eastman Dental Clinic, adjoining that of the Royal Free Hospital, London, is being cleared and work will

presently be started on the building, which is to follow the lines of the Rochester Dental Dispensary, with such variations as are necessary to have the building in keeping with the Royal Free Hospital architecturally. A group composed of the hospital trustees and London philanthropists, headed by Lord Riddell, publisher, and Albert Levy, retired manufacturer, have guaranteed to raise the $1,000,000 necessary for an endowment fund. Besides dental work, adenoid and tonsil operations will be performed, relieving the overcrowded conditions in the children's hospitals, whose facilities for taking care of these cases are very limited. It is planned to have a capacity double that of the Rochester Dental Dispensary. The main dental clinic, on the second floor, will be equipped with fifty chairs, and on the same floor will be the orthodontic department, extracting and recovery room and hospital for tonsil and cleft palate operations. The mezzanine floor will provide space for a roentgen-ray room and a ward for the tonsil and adenoid cases. The basement and first floor will contain the service rooms, class rooms, offices, waiting room and ward for cleft palate and tonsil cases. Harvey J. Burkhart, of Rochester, was in London during the past summer in conference with the authorities regarding details for operation of the clinic.

General

Dr. Winter Returns from France: George B. Winter, of St. Louis, returned, September 17, from Paris, where he was called to give a clinic before the American Dental Society of Europe. The clinics were held at the American Hospital at Neuilly.

"Health Glass" Used in Office Building: The Equitable Trust Building in New York City is said to be the first office building to employ a type of window glass permitting the passage of the ultraviolet rays of the sun. Some hotels have installed this type of glass, notably in Chicago, and it is said that several London banks are making use of it in an effort to give their employes all the possible advantages of the meager London sunshine.

Deaths

Baird, Henry M., St. Louis, Mo.; State University of Iowa, College of Dentistry, 1886; died, June 26.

Boxton, Charles, San Francisco, Calif.; University of Southern California, College of Dentistry, 1883; died, August 29.

Chapman, J. R., Kansas City, Kan.; died, September 10; aged 78. Dr. Chapman had practiced dentistry in Kansas City for fifty years.

Clarke, George H., Kingston, N. Y.; Pennsylvania College of Dental Surgery, 1904; died recently.

Daly, Thomas J., Jr., Jersey City, N. J.; Georgetown University, School of Dentistry, 1914; died May 11.

Daniel, Roy Clifton, Oklahoma City, Okla.; Louisville College of Dental Surgery, 1906; died, June 5; aged 42.

Dayan, Squire Chase, Syracuse, N. Y.; Pennsylvania College of Dental Surgery, 1868; died, August 25; aged 81. Dr. Dayan enlisted in the Civil War at the age of 15, as a drummer boy, and served for four years. He practiced dentistry in Syracuse for fifty-one years and served four years as dental consulting surgeon at St. Joseph Hospital.

Dowe, Percy E., New York City; New York College of Dentistry, 1894; died recently.

Fewell, Wallace P., Madison, Ind.; Central College of Dentistry, 1904; died in August.

Gray, Francis, Westwood, N. J.; New York College of Dentistry, 1890; died, June 9; aged 65.

Grace, Edward H., Logansport, Ind.; Indiana University School of Dentistry, 1895; died, September 3.

Hall, George A., Lima, Ohio; died, June 2, from heart disease; aged 85. Dr. Hall entered on the practice of dentistry on his return from the Civil War, in 1867. He was postmaster at Lima for ten years and was actively engaged in dental practice until three months before his death.

Hart, Julian B., New York City; College of Dental and Oral Surgery of New York, 1914; died recently.

Hicks, E. M., Murfreesboro, Tenn.; died recently.

House, E. E., Boston, Mass.; Tufts College Dental School, 1884; died, June 13; aged 66.

Huhn, Lloyd S., Chicago, Ill.; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1904; died, April 23; aged 49.

Jones, Sam, Shelbyville, Tenn.; died, August 27; aged 51.

Kelly, Jennie L., Chicago, Ill.; American College of Dental Surgery, 1892; died, June 13.

Kimball, Charles Denny, New York City; New York Dental School, 1904; died, May 27; aged 52. Dr. Kimball was also a graduate of the Bellevue Medical School and New York University.

Kimball, John H., Bangor, Maine; died suddenly, September 17; aged 78. Dr. Kimball had practiced in Bangor for half a century. He retired two years ago.

Knight, Joseph King, Hyde Park, Mass.; Tufts College Dental School, 1883; died, September 11; aged 78. He was a teacher in his alma mater (known as Boston Dental College, 1868-1899) from 1888 to 1911. In 1894, he served as president of the Massachusetts Dental Society.

Laign, Edward A., Elizabeth, Ill.; Northwestern Dental School, 1904; died, September 10; aged 47. Death was due to pneumonia.

Lewis, A. W., Oxford, Mich.; University of Michigan College of Dental Surgery, 1902; died, June 18; aged 45.

Long, Lewis A., Cincinnati, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1891; died, September 15; aged 61. He is survived by his wife and one son, Stanley, who was associated with him in practice.

Mann, William Tanner, Nashville, Tenn.; Northwestern University Dental School, 1905; died, May 28; aged 49.

Mason, Finley H., Spokane, Wash.; American College of Dental Surgery, 1893; died, August 3.

Meyer, Zeno F., Milwaukee, Wis.; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1891; died recently.

Minoff, Jochannan, Brooklyn, N. Y.; College of Dentistry and Oral Surgery of New York, 1918; was killed in an automobile accident, August 22.

Osborn, Seth G., Monticello, N. Y.; died, September 16, after a long illness.

Parker, Wilbur B., Cambridge, Mass.; Harvard University Dental School, 1875; died, May 24; aged 81.

Petty, W. W., Huntington, W. Va.; Vanderbilt University, School of Dentistry, 1918; died, July 2, after a year's illness; aged 40. Dr. Petty saw service overseas in the World War, serving as lieutenant in the dental corps. His death occurred in the government hospital in Oteen, N. C.

Rogers, William H., New York City; New York College of Dentistry, 1894; died, August 20. Dr. Rogers was an ex-president of the Second District Dental Society.

Ross, Albert O., Columbus, Ohio; Ohio College of Dental Surgery, Dental Department of the University of Cincinnati, 1882; died recently.

Shoemaker, R. H., Pasadena, Calif.; Pennsylvania College of Dental Surgery, 1884; died recently.

Springdale, George A., Malden, Mass.; Tufts College Dental School, 1912; was killed in an automobile accident, June 17.

Surgison, John R., Charlotteville, Va.; died, June 26; aged 74. Dr. Surgison practiced in Wheeling before his retirement ten years ago.

Stryker, S. W., Portland, Ore.; died, July 17, aged 63, as a result of injuries received when, with eight companions, he slipped on the north slope of Mount Hood, and after a descent of 600 feet, fell into a crevasse 30 feet deep. Dr. Stryker's alpenstock penetrated his right side, and death ensued within four hours.

Thomas, Roy, Valdosta, Ga.; Southern Dental College, 1903; died, August 17; aged 45.

Trueman, William H., Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1865; died, August 4; aged 84. Dr. Trueman practiced dentistry for fifty-six years, retiring eight years ago. He was a veteran of the Civil War, a writer and a member of a number of historical societies. A paper by Dr. Trueman, "The Beginning and International Growth of Dental Journalism," read before the recent Congress, was published in the March issue of THE JOURNAL.

Van Woert, F. T., New York City; University of Buffalo, School of Dentistry, 1905; died, September 1.

Wood, Perry G., Corry, Pa.; Pennsylvania College of Dental Surgery, 7887; died, recently.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Dental Infections: In discussing dental infections, as to systemic manifestations and bacteriologic observations, Goldberg, (*J.A.M.A.*, July 30, 1927) says: "Too often, in cases of suspected focal infection, extraction of the teeth has been carried out without resultant change in the general condition. Doubtless, many of these teeth could have been saved had the physician and dentist consulted before operation. It is to be regretted that such consultations are not more frequently held in cases of this type." He urges a more careful diagnosis of the condition in question in order to determine whether in the teeth and gums lies the source of infection. Cooperation between dentist and physician should begin in their respective colleges. A hospital offers unusual opportunity for cooperation between the two professions. The following procedure is suggested as a basis for diagnosis in cases of focal infection: 1. A thorough medical history is secured. 2. Data on blood pressure, blood count, Wassermann reaction and urinalysis are obtained. It is advisable to get this information through the physician, as the patient may not be willing to give it to the dentist. The medical history, as will be shown later, plays a very important part in dental diagnosis. 3. A thorough clinical examination is made of the teeth, gums and sinuses. 4. A roentgen-ray examination of the teeth and sinuses is made. 5. Each tooth is eliminated as a possible cause of infection. 6. As nearly as possible, the date when each treated tooth was filled and crowned should be known to the dentist, as there is generally a definite period between the time the tooth becomes infected and the first expression of the systemic sequelae. This varies in different patients, depending on individual resistance and immunity. The author considers that hospital training is indispensable in properly diagnosing these cases. He advocates a dental staff for every hospital, and urges that dentists doing hospital work organize and decide on a definite procedure for handling these cases, as they will not until then receive the full cooperation of the medical profession, which is not encouraged by the lack of unanimity of opinion among dentists at present.

Ultraviolet Light in Dental Conditions: Folstein, in a study of ultraviolet light in the treatment of abscessed teeth and pyorrhea alveolaris (*Arch. Phys. Ther. X-Ray Rad.*, July, 1927), emphasizes the fact that it is "worth everything to try to conserve the human teeth." He rigidly questions the physician who concludes that all systemic conditions of obscure origin can be traced to the teeth, and whose patients, after hearing the physician's verdict, are so hard to convince that some measure other than extraction will probably accomplish the desired result. The author successfully applies the ultraviolet ray in cases of abscessed teeth, after employing chemical and mechanical measures, preceded by roentgen-ray examination and opening of the tooth. Treatment is given every second day, facially and lingually. In about three weeks, the root canal is filled, and roentgenograms show removal of the focus of infection and regeneration of bone and peridental structures. A fistulous tract is treated similarly. In pyorrhea, simply scaling the teeth and applying the rays has resulted in eradication of pus and sponginess of the gums, tightening of loose teeth, cessation of bleeding and regeneration of membranes and alveolar process. Results are obtained in from one to three months. A quartz rod is applied directly to the membranes affected, and is inserted in pus pockets. The treatment has the additional desirable feature of being without pain and strain on the patient, and no home treatment is demanded of him.

Congenital Syphilis: In a study of 202 cases of congenital syphilis representing 181 mothers, it was found that the more recent

the infection in the mother, the more frequently the children were affected and the severer the type of infection. Only 23 per cent of the mothers had received treatment before or during pregnancy. The greater number of these cases represented the first pregnancy. The average age at which symptoms developed was between the tenth and fifteenth years. Ninety-one per cent of the patients were normal mentally. Interstitial keratitis was the most frequent symptom occurring in 35 per cent of the cases. Dental defects were the most common physical sign. The Wassermann reaction and organic luetin tests were strongly to moderately positive in all except two cases. Spinal fluid tests were positive in 10.5 per cent. The plan of treatment was continuous. There were fourteen cases of syphilitic nephritis. All were fatal and all were studied at autopsy. There were four cases of meningitis, all of which were fatal. Three were examined at autopsy.—A. Benson Cannon, in *J.A.M.A.*, Aug. 27, 1927.

Standardization of Roentgen-Ray Shadows: Lurie (*Arch. Phys. Ther. X-Ray Rad.*, July, 1927) considers the standardization of terminology as of great importance in the study and interpretation of roentgen-ray shadows. Transparency, radiopacity, radioparency and radiolucency are all comparative terms. Every area pictured should have a fixed ratio of tissue and bone, with slight deviations still to be considered normal. When soft tissue replaces bone, or vice versa, an abnormal condition exists. Force of penetration of the rays can be measured and duplicated at will, but, beyond that, standardization becomes difficult. Opacity and translucency are not identical in any two pictures. Density is virtually a fixed quantity. Resistance to penetration of the ray depends on the variation in organic salt content of the tissues, and the slightest deviation from the normal is detectable. Therefore, the establishment of the inorganic salt content of the tissues as a constant factor in roentgen-ray resistance is a further step toward standardization of shadows, and so toward determination of their pathologic import. The author concludes: "The shadows seen are an expression of anatomical entities, which govern the penetration of light in ratio to their inorganic salt content. The problem is to understand the histological construction of parts and the changes pathological processes produce. An intimate study of shadows and their values is an accurate means of diagnosing dental pathology as pictured on the dental x-ray film. A better understanding of pathology and its inorganic chemistry is an aid in the association of x-ray shadow values and local or general symptomatology as seen on the dental x-ray film."

Fracture of Upper and Lower Jaw: The fundamental principles for treating fractures in general hold good in the treatment of jaw fractures. The means of their application vary. Of first importance is the diagnosis. Opening and closing of the mouth while maintaining proper occlusion is never possible in any jaw fracture if much displacement exists. Malocclusion is the rule; tenderness on pressure over the fracture point is always present. In condyle or neck fracture, the chin swings toward the involved side on opening; occlusion may be normal. Diagnosis is easy in fracture of the body and the jaw or on the gingival process of either jaw. The fingers must grasp the bone on either side of the fracture, testing for mobility. The roentgen ray is most important both before and after reduction. Reduction is the second principle. Reduction is often easily obtained by having the patient make an effort to open or close the mouth while manipulation is being done. Fragments that have become fixed can be drawn into line by elastic traction, special appliances being necessary. Pull and counter pull are to be used as in fractures elsewhere. Early reduction is best. Fixation is the third principle. How to obtain it is a mere detail, there being no routine practice. The fixed point important for the upper jaw is the skull itself; for the lower jaw, the upper one. The fracture in the tooth-bearing area is always compound. Loose teeth should be conserved if possible; teeth which are loose after three weeks should always be taken out. The mouth should never be closed while the patient is asleep. Nonunion should occur only because of loss of bony substance at the time of injury, never because of necrosis. Nonunion is best treated by bone graft. Ankylosis is generally due to lack of knowledge or carelessness, never to immobilization *per se;* hence, infection. The dirty mouth is responsible for a lot of trouble; cleanliness is obtainable by frequent

washing. Nourishment is very important. All patients on liquid nourishment should be fed every two hours.—W. T. Coughlin, in *J.A.M.A.* (Soc. Proc.), July 23, 1927.

Ultraviolet Radiation: In a discussion of ultraviolet radiation, Kime (*Arch. Phys. Ther. X-Ray Rad.*, July, 1927) cites the following cases: The 3-year-old daughter of a dentist, overweight, undermetabolized, anemic and definitely rachitic, developed a severe compensatory reaction in the form of fever, and was brought in in a serious condition. Calcium was given by mouth, and iron hypodermically, and, very cautiously, systemic ultraviolet therapy was started. In three weeks, the hemoglobin was raised from 40 to 60 per cent, and thence continued upward. The rachitic symptoms gradually disappeared. The hair began to grow, the teeth erupted and the child made a complete recovery. In another case, a boy, aged 4, had osteomyelitis of the mandible, with extensive abscess formation of the entire jaw, which almost reached the shoulders. There were sinuses on either side of the angle of the jaw and inside the mouth, and the teeth were loose, but there was no definite bony sequestrum. The referring surgeon requested systemic radiation and no other treatment. The child was almost moribund. In the first month, the anemia began to disappear. The next month, the sinuses closed on the inside of the mouth. In the third month, the abscess subsided, and, at the end of the month, the articular process of the neck and a large part of the ramus of the mandible was taken from the wound by the patient himself. The periosteum is intact, and it is hoped that regeneration of bone will compensate the loss. There was no interference with mastication.

Honor System in Medical Practice: Medical men must view each other as friends, not as rivals. They must think of each other as devoted to a common cause and under common handicaps. Physicians must learn to discount properly the statements made by patients about fellow physicians, and to recognize the inevitable human tendency to place emphasis unduly on points favorable to a preferred point of view. There are always a few places where it is difficult to make the code fit when it is viewed on too technical a basis. There is much talk of the absurdities of medical ethics on the part of individuals who do not understand the life of the profession. It is hard for them to see that in the long run it is only by sound ethical procedure that the welfare of the patient is properly protected. If he is made the plaything of prejudice and is to be the subject of contest between members of the profession, it is inevitable that his best interests will suffer. We have to remember that time and skill are all that a physician has to offer, that he needs protection of his time and the opportunity to use his skill, and must not consume his energy in misunderstandings.—Ray Lyman Wilbur, in *J.A.M.A.*, Aug. 20, 1927.

The Tooth Brush: At the suggestion of the New Haven Health Department a preliminary study of the bacteriology of the toothbrush has recently been completed by C. E. A. Winslow and Louis DeAngelis of the Yale Department of Public Health. Twenty-four toothbrushes were submitted by different individuals. These brushes were taken to the laboratory in sterile tubes. Each brush was immersed in a large test tube containing salt solution and rubbed up and down over the surface of an inclined strip of corrugated glass in the tube. The toothbrush was then removed from the tube and the saline suspensions used for the various examinations, hence the information obtained was based not on the bacterial content of the brushes but from the bacteria that were removed from them. There was a wide variation in the number of bacteria found on these brushes from zero to over three million. Besides the number of germs, the investigators were interested in several varieties of bacteria. Acid-forming bacteria were found in numbers ranging from zero to 20,000 per brush. Hemolytic streptococci were found in amounts ranging from zero to 300,000. No Bact. coli were found. Apparently there is a close relationship between the length of time that a toothbrush has been in use and the number of bacteria it contains. The medium bacteria count of brushes used three months or less was 900 as contrasted with over 160,000 bacteria on brushes used four months and over. The only brushes that showed over 1,000 acid-forming bacteria were two, one of which had been used for a year and two months, and the other for two years. The two highest counts for hemolytic streptococci were on brushes that had been in use for one and two years respectively. As a

control to this part of the study, six unused brushes purchased in the open market, all of which except one were exposed to the air, yielded bacterial counts from zero to 210. Three of these brushes showed hemolytic streptococci and three showed acid forming bacteria. Brushes used in mouths where the teeth were in good condition had low bacteria counts. On the other hand brushes used in mouths where the teeth were dirty or had cavities had 100 times as many bacteria. The number of bacteria was also found to be related to the condition of the brush. Brushes that were dirty or matted not only yielded large numbers of bacteria but many hemolytic streptococci and acid formers. The use of a dentifrice is shown to have an effect on the number of germs on toothbrushes. Five brushes used by individuals who did not use a dentifrice all had high bacterial counts. Hot water was employed for rinsing the brushes by five people and four of the five brushes had a very low number of bacteria. In the group of twenty-four brushes there were three where it was admitted that they were used promiscuously. These all showed high counts and were high in acid formers and hemolytic streptococci. This study also suggests that the number of bacteria on a toothbrush after using does not increase on standing five and nine hours, but decreases.—*Bulletin of New Haven, Conn., Health Department*, in *Boston M. & S. Jour.*, July 28, 1927.

Report of Medical Association on Ethylene: The following are conclusions appended to a report on ethylene gas based on tests made in the laboratory of the American Medical Association: 1. Specimens of Baxter's Ethylene for Anesthesia, in addition to the brands now described in New and Nonofficial Remedies (namely, those of the Ohio Chemical and Manufacturing Company and the Kansas City Oxygen Gas Company, previously reported on by this laboratory), have been examined. All the specimens examined have been found to be satisfactory and to conform to the standards accepted for inclusion in New and Nonofficial Remedies. 2. A specimen of suspected Ethylene for Anesthesia (Kansas City Oxygen Gas Company) was also examined, and was found to be of satisfactory purity. No so-called blue gas was noticed. 3. The laboratory again repeats its previous recommendations, that physicians use only the brands of ethylene described in New and Nonofficial Remedies. Furthermore, that manufacturers test their products according to the standards in New and Nonofficial Remedies (including the hemoglobin test which has been incorporated in the standards), and that such statement of examination accompany each tank of ethylene.

Optic Nerve Disturbances from Focal Infection: A definite focus was found in fifty-three of the sixty unreported cases. The tonsils appeared to be the only focus in seventeen, the teeth in fourteen and the antrum in two. Teeth and tonsils either alone or combined were considered to be the focus in 70 per cent. In but six cases were the ethmoids involved, and even in these there were also infected teeth, tonsils or antrum. The frontal and sphenoid were each involved but twice. The removal of the focus was followed by normal vision in 50 per cent and marked improvement in 25 per cent. Much better results would have been obtained had the focus been removed earlier.—Leon E. White, in *Boston M. & S. J.*, April 21, 1927.

Treatment of Thrush: Writing in *Monatschrift für Kinderheilkunde*, Dr. R. Fischl advises the local application of a solution of ferric chloride, varying in strength from five to twenty per cent, in cases of thrush. In the cases treated by him, the thrush disappeared in forty-eight hours or less. This suggestion should be well worth consideration. It is a comparatively simple matter to deal with thrush, but it is by no means simple to deal with it in less than forty-eight hours.—*Dent. Surgeon*, April 16, 1927.

Carbon Monoxid Poisoning Following Ethylene Anesthesia: In a final report, the authors, W. O. Sherman, C. M. Swindler, and W. S. Ellroy (*J.A.M.A.*, April 16, 1927) reach the following conclusions: 1. It has been found that there is danger of carbon monoxide poisoning in the use of ethylene for anesthesia. 2. Analyses of a number of samples of ethylene marketed for anesthetic purposes show the presence of carbon monoxide in amounts ranging from traces to poisonous quantities, indicating the inadequacy in the method of preparation of ethylene safe for anesthesia. All drugs used for anesthesia should be analyzed and their purity properly certified. In the case of ethylene, when the possible presence of even a trace

of carbon monoxide may be inferred, the analysis and certification should be for each individual container from which the ethylene is used, and the absolute quantity of carbon monoxide permissible in any container should not reach that which would produce toxic symptoms should it happen to be administered all at one time; for, under certain physical conditions, carbon monoxide may separate out from the ethylene and reach the patient in higher concentration than is usually interpreted from the relative figures given in percentages. 3. There is a reliable method of testing for carbon monoxide in ethylene. 4. By the method of purification known as fractionation, an absolutely pure ethylene so far as carbon monoxide is concerned, can be obtained at a reasonable cost; by using this process, a source of supply from certain natural gases can be made available. 5. Clinical observations suggest that a technic of administration can be developed which greatly minimizes the danger of explosion and renders the administration of ethylene reasonably safe.

Teeth and Teething: The anomalies of the jaw and palate are mentioned as features of interest in the new-born. Heredity, thumb sucking and nasal obstruction are given etiologic significance. Rickets is the factor of greatest importance in delayed dentition, although in myxedema the delay is more pronounced. Family peculiarities can also be observed, and it is incorrect to assume a metabolic disorder in every case of delayed dentition. Some hereditary peculiarity is now thought to be the important factor in dentition praecox. The relationship of teething to disorders of childhood is one of coincidence and the reasons for their association is given. Anomalies of the teeth due to rickets, syphilis and malnutrition are described and dental caries and its etiology are considered.—H. Kleinschmidt, *Pediatria;* abstr. *Am. J. Dis. Child.*

Actinomycosis of the Nasopharynx and Soft Palate: Montgomery's patient was a girl, aged 12. Swelling of the submaxillary nodes of the left side was the first manifestation. These subsided but again swelled four months later. Tuberculosis was suspected because the mother had a history of tuberculosis three years before. A small yellow nodule was found on the soft palate and one on the posterior pharyngeal wall. Ray fungus was obtained from the first. After local cauterization with copper sulphate and saturation of the system with potassium iodid, the nodes were completely healed and the patient's physical condition improved. Montgomery gives a guarded prognosis, fearing the development of gastro-intestinal or renal infection.—*Northwest Med.*, abstr. *Am. J. Dis. Child.*

Congenital Cleft Lip: Surgeons interested in reparation and corrective surgery seek to attain perfection from the anatomic and physiologic as well as from the cosmetic point of view. In the correction of congenital cleft lip, one has to close an unsightly gap in such a manner as to restore the function of the parts, and the closure must be planned to minimize visible scars, to give flexibility, fullness and length to the lip, and to restore symmetry of the nostrils. The best indication of time for operation is a consistent gain in weight, a good state of nutrition and absence of local infection. Correction of the alveolar deformity must precede every other operation. The cooperation of a pediatrician is vital to complete success. The patient should become accustomed to the nurse who is to take charge of him before operation. It is also important that the patient become accustomed to the method of feeding which will be used after the operation. Sucking should not be allowed for some time before or after the operation. The author (T. F. Mullen, *M. J. & Rec.*) then gives, in detail, the operation for this condition. After the operation, the child should be kept quiet by any means. The mother should stay in the hospital with the infant and the breast milk be pumped and fed with a sterile spoon or dropper at regular intervals. Examination is avoided as much as possible for the first few days and the lip and mouth syringed daily with sterile water.—Abstr. *Am. J. Dis. Child.*

Diet and Dentition: A child can digest better the banana ripened on the tree, where the starch is transformed into fructose, than the banana ripened en route. The digestibility of the fruit is altered. In children having trouble with dentition, I use corn meal for its carbohydrate and energy content, and I order vegetables given with the water in which they are boiled. In cases of gastro-intestinal intoxication, I have given raw carrot juice or turnip juice with great advantage. The teeth came more promptly and the gums

improved in condition. I believe that the American diet for children has too low an inorganic salt content. By adding calcium and phosphorus, one can balance the metabolism better.—George Dow Scott, in *J.A.M.A.*

Cancer of Skin: Twenty-nine cases are reported by Morton. He is certain that a combination of surgery and radiotherapy is desirable in every case. The primary growth should be disposed of rapidly by electrocoagulation or cautery removal, thus eliminating one dangerous zone as a focus from which metastasis may occur. Squamous cell cancers of the scalp and forehead do not require removal of the regional glands; cancers of the face, cheek, eyelid, chin and nose, however, should have the glands removed also. Growths on the extremities and scrotum are prone to metastasize, and the regional glands are frequently involved. The squamous cell growths on the ear may metastasize to the parotid, pre auricular or postauricular glands or to glands of the neck. Whenever possible, cooperation between surgeon and radiotherapist will offer the best chance of bettering results.—*Arch Surg.*; abstr. *J.A.M.A.*

Relation of Endocrine Glands to Teeth in Rickets: The author (W. G. Ward, in *M. J. & Rec.*) states that rickets is caused entirely by an endocrine unbalance inherited from the mother. In rickets, together with the bone lesions, we find delayed dentition, also that the teeth decay rapidly. The endocrine glands prominently identified in the development and protection of the teeth are the thyroid, parathyroid, pituitary, gonads, suprarenals and thymus. These glands also govern the calcium content in our bodies. The thymus gland has been found atrophied in cases of rickets and marasmus. Ward also states that rickets is not due to a deficiency in diet, but to a deficiency of the endocrine glands which control the retention of calcium salts in the body. The beneficial results reported from treatment by cod liver oil, roentgen ray, violet ray, the quartz lamp and sunshine are due really to the stimulation of the endocrine glands. The rays also by their stimulation of the glands raise the blood calcium.—Abstr. *Am. J. Dis. Child.*

Treatment of Hemophilia Trauner: (*Wein. klin. Wchnschr.*) found that thorough lavage of the colon may stop dangerous hemorrhages after extraction of the teeth in bleeders.—Abstr. *J.A.M.A.*, April 23, 1927.

New Routes for Anesthetizing the Jaw: Lindemann (*Deutsch. Ztschr. f. Chir.*) describes in detail the methods for obtaining local anesthesia of the upper and lower jaw, respectively, in use in the West German Jaw Clinic in Dusseldorf. In each case, the needle is introduced into the infratemporal fossa, and the third or the second branch of the trigeminus, as indicated, is located by the aid of certain landmarks and injected. He claims safety and simplicity for the methods. They have the advantages of avoiding the intra-oral route and of making the injection at a distance from the disease focus.—Abstr. *J.A.M.A.*, April 16, 1927.

Etiology of Dental Caries: A summary of results to date obtained by McIntosh et al. in this study shows that saliva appears to be intimately connected with the occurrence or nonoccurrence of dental caries, being more acid in those subject to the condition than in those who are immune. Experiments devised to show that teeth vary in their powers of resisting acid were inconclusive. The saliva may contain agglutinins against *B. acidolphilus-odontolyticus*, but only in small quantities. Saliva has no appreciable bactericidal action against *B. acidolphilus-odontolyticus.*—*Brit. J. Exper. Pathol.* abstr. *J.A.M.A.*

Cancer of the Tongue: Finochietto states that in the case described ligation and severing of the lingual arteries on both sides reduced the large cancer on the tongue to a fifth of its former size in a very few days. With invasion of the tonsils, he ligates the inferior pharyngeal arteries also. He relates some typical instances to show the advantages of preliminary ligation before operating on the tongue, or as a palliative measure in inoperable cases.—*Semana Med.*, abstr. *J.A.M.A.*

Excision and Restoration of Upper Lip. Pickerill (*Brit. J. Surg.*) has reported instances, in a previous communication, in young men, for whom considerable restorations of lost portions of the face had been undertaken by means of tube-grafts, including the double tube-graft flap, which he originated in 1918. He now shows by a case report that such grafts are also successful in older men. A man, aged 65, was admitted with a large fungating growth of the upper lip, about the size of a hen's egg. Pickerill excised the upper lip under local anesthesia. Six weeks later, plastic restoration was commenced. The first stage was to form the new lip from

two flaps, one from the chest for the inner surface and one from the scalp for the outer surface. The scalp flap is superimposed on the chest flap, united and allowed to lie alongside the left ear for a fortnight. The lower end is then divided, swung across, and inserted in the prepared bed on the right and upper borders of the excision wound. At the next stage the graft is divided and the proximal end inserted into the left side of the excision wound. The scalp tube is opened out and replaced. The patient, of course, was enabled rapidly to grow a moustache. A point of interest lies in the excellent substitute chest skin makes for mucous membrane when transferred by double tube flaps. The extraordinary thing is that if the same skin were grafted into the same area as a free graft, it would remain white and would never take on the appearance of mucous membrane.—Abstr. *Am. J. Surg.*, April, 1927.

Place of Preventive Medicine in Medical School: I do not know any better way of closing this or to summarize what I have been trying to say than to quote the impressive words of the late Dr. Sedgwick, who said: "The medical school which fails today to provide also liberal instruction in preventive medicine, in vital statistics, in sanitary science, in public health laboratory methods, in epidemiology; in preventive sanitation, such as the sanitation of water supplies and other branches of municipal sanitation; in preventive hygiene, such as mental, social, personal and dental hygiene; and in public health education and public health administration—that medical school is sending out its graduates unprepared for some of the most serious problems they will have to face in the immediate future. Obviously all these subjects cannot be injected into a curriculum already overcrowded . . . . That medical school which first begins this reformation will seize a golden opportunity."—W. S. Leathers, in *J.A.M.A.*, March 26, 1927.

Studies on Relationship of Endemic Goiter to Potential Foci of Infection: The existence of dental decay does not necessarily imply focal infection. In fact, it is probable that septic absorption occurs most frequently when decay has extended to the root canal. Obviously it was difficult to determine this point accurately during the survey. However, many of the markedly decayed teeth were presumably serving as sources of infective material. It is also reasonable to assume that the possibilities for systemic infection are increased in the presence of successively greater numbers of markedly decayed teeth. In classifying the degrees of decay a distinction was made between the slight and marked forms. In the former class were included teeth with small yet distinct and presumably easily remediable defects. Under the heading "markedly decayed" were included teeth having large cavities of considerable duration, perforations of the pulp cavity, and those obviously in need of extraction. An obvious omission in the present investigation is the lack of information concerning filled and missing teeth. It is readily conceivable that a decayed tooth may have served as a focus of infection prior to being filled. It may also be said that filled teeth are usually a sign of efficient dental hygiene, the necessary corrective steps being taken early, possibly before any opportunity for systemic infection was afforded. Furthermore, in a tooth capable of salvage by filling, the decay has seldom penetrated the root cavity, thereby lessening the opportunity for harmful influence. With regard to missing teeth, it may be admitted that teeth are usually extracted because of such extensive decay that filling is impracticable. Whether or not decayed teeth prior to extraction exert temporarily or permanently deleterious effects upon the thyroids is obviously a matter for more extended study than was possible during the present investigation. Such a possibility must certainly be considered, for it may be that enlargement of the thyroid remains after the infective focus has been removed.—Robert Olesen and Neil E. Taylor, in *Pub. Health Rep.*

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Association of Dental Schools, March 26-28, 1928, Washington, D. C.

American Society of Orthodontists, April 30-May 1-3, 1928, Buffalo, N. Y.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesday in each month from October to June inclusive.

November (1927)

Arizona, at Phoenix.
Florida, at St. Petersburg (10-12).

December (1927)

Nevada, at Reno (9).
Ohio, at Cleveland (6-8).

February (1928)

Minnesota, at Minneapolis (Feb. 29-March 2).

March (1928)

Louisiana, at Shreveport.
Montana, at Missoula (29-31).

April (1928)

Alabama, at Mobile (10-12).
California, at Stockton (9-12).
Connecticut, at New Haven (11-13).
Kansas, at Topeka.
Kentucky, at Louisville (3-5).
Maryland, at Baltimore (April 30-May 2).
New Jersey, at Asbury Park (18-20).
North Carolina, at Charlotte (16-18).
Oklahoma, at Tulsa.

May (1928)

Arkansas, at Little Rock (14).
Illinois, at Rock Island (8-10).
Indiana, at Indianapolis (21-23).
Iowa, at Des Moines (1-3).
Massachusetts, at Boston (7-11).
Missouri, at Kansas City (14-17).
Nebraska, at Lincoln (14-17).
New York, at Syracuse (16-18).
Pennsylvania, at Altoona (15-17).
Tennessee, at Nashville.
West Virginia, at Parkersburg (14-16).

June (1928)

Georgia, at Atlanta.
Idaho, at Boise.
Texas, at El Paso (5-7).
Vermont, at Burlington.
Wyoming, at Casper.

July (1928)

Wisconsin, at Milwaukee.

Chicago Dental Society, at Chicago, January 24-26, 1928.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Connecticut, at Hartford, November 15-17, 1927. Recorder, Arthur B. Holmes, 80 Central Avenue, Waterbury, Connecticut.

Indiana, at Indianapolis, November 14, 1927. Secretary-Treasurer, J. M. Hale, Mt. Vernon, Indiana.

Iowa, at Iowa City, December 12-15, 1927. Director of Examination and Licenses, H. W. Grefe.

Michigan, at Ann Arbor, November 14-19, 1927. Secretary, J. W. Lyons, 617-621 Dwight Building, Jackson, Michigan.

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

Minnesota, at Minneapolis, December 12-17, 1927. Secretary, F. E. Cobb, 601 Donaldson Building, Minneapolis, Minnesota.

New Jersey, at Trenton, December 5-10, 1927. Secretary, John C. Forsyth, 148 W. State St., Trenton, New Jersey.

Pennsylvania, at Philadelphia and Pittsburgh, December 12-15, 1927. Secretary, Alexander H. Reynolds, 4630 Chester Avenue, Philadelphia, Pennsylvania.

Texas, at Houston, December 15, 1927. Secretary, Maxwell C. Murphy, City National Bank Building, Temple, Texas.

ALABAMA DENTAL ASSOCIATION

The next meeting of the Alabama Dental Association will be held in Mobile, April 10-12, 1928.

FRANK F. PERRY, *Sec'y-Treas.*,
Montgomery, Ala.

CONNECTICUT STATE DENTAL ASSOCIATION

The sixty-fourth annual meeting of the Connecticut State Dental Association will be held April 11, 12, 13, 1928, in New Haven, Conn.

The Chairman of the Exhibit Committee is A. B. Rosoff, New Haven, Conn.

J. A. BRAY, *Secretary*,
Hartford, Conn.

FLORIDA STATE DENTAL SOCIETY
(A correction)

The next meeting of the Florida State Dental Society will be held at St. Petersburg, Nov. 10-12, 1927.

C. C. STEWART, *Sec'y-Treas.*,
St. Petersburg, Fla.

KENTUCKY STATE DENTAL ASSOCIATION

The fifty-ninth annual meeting of the Kentucky State Dental Association will be held at Louisville, April 3-5, 1928, at the Brown Hotel.

FRANK B. HOWER, *Secretary*,
Francis Bldg.,
Louisville, Ky.

MISSOURI STATE DENTAL ASSOCIATION

The next meeting of the Missouri Dental Association will be held, May 14-17, 1928, at Kansas City, at the Shrine Temple.

R. J. RINEHART, *President*,
H. C. POLLOCK, *Secretary*,
4482 Washington St.,
St. Louis, Mo.

NEW JERSEY STATE DENTAL SOCIETY

The fifty-eighth annual session of the New Jersey State Dental Society will be held in the Berkeley-Carteret Hotel, Asbury Park, April 18-20, 1928.

F. K. HEAZELTON, *Secretary*,
223 East Hanover St.,
Trenton, N. J.

STATE OF MINNESOTA BOARD OF DENTAL EXAMINERS

The Minnesota State Board of Dental Examiners will hold its next examination at the College of Dentistry, University of Minnesota, Minneapolis, Dec. 12-17, 1927. Application must be in the hands of the secretary not later than December 1.

F. E. COBB, *Secretary*,
601 Donaldson Bldg.,
Minneapolis, Minn.

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF PUBLIC INSTRUCTION, STATE BOARD OF DENTAL EXAMINERS

The next regular examination by the Pennsylvania State Dental Council and Examining Board will be held in Philadelphia and Pittburgh, December 12-15. The theoretical examination will be held at the University of Pittsburgh, Pittsburgh, and at the City Hall, Philadelphia. The examination in practical work will be held at the University of Pittsburgh and at Temple University, Philadelphia, December 15, at 8:30 a. m. An examination for hygienists will be held at the same time and places. Application

papers may be secured from the Department of Public Instruction, Harrisburg. For further information, address

ALEXANDER H. REYNOLDS, *Secretary*,
4630 Chester Ave.,
Philadelphia, Pa.

TEXAS STATE BOARD OF DENTAL EXAMINERS

The Texas State Board of Dental Examiners will hold its next examination in Houston, Texas, at Texas Dental College, beginning Dec. 12, and continuing through Dec. 15, 1927. The written examinations shall be in the English language in the following subjects: operative dentistry, prosthetic dentistry, chemistry, histology, pathology and bacteriology, anatomy, orthodontia, materia medica, therapeutics, oral surgery, anesthesia, and physiology. The examination fee is $25.00 and must accompany all applications. Applications should be in the hands of the secretary at least five days before the examination.

MAXWELL C. MURPHY, *Secretary*,
City National Bank Bldg.,
Temple, Texas.

NEW YORK SOCIETY OF ORTHODONTISTS

The next meeting of the New York Society of Orthodontists will be held the morning and afternoon of Dec. 14, 1927, at the Hotel Commodore, New York City. An unusually extensive and attractive program has been arranged for this meeting. The morning session is planned especially for the orthodontist, while the afternoon session will be of interest to both the specialist and the general practitioner. A nationally known dental practitioner and educator will address the afternoon meeting, and an important report based on clinical research will also be presented. A cordial invitation is extended to all ethical members of the dental and medical professions to attend the afternoon session.

WILLIAM C. FISHER, *Secretary*,
501 Fifth Ave.,
New York City.

IOWA STATE DEPARTMENT OF HEALTH

The Iowa State Board of Dental Examiners will meet at the State University of Iowa College of Dentistry, Iowa City, Dec. 12-15, 1927, at 9 a. m., for the purpose of examining applicants for a license to practice dentistry in Iowa. An examination for dental hygienists will be given. For further information and application blanks, address the State Department of Health, Capitol Building, Des Moines. All papers and credentials must be filed with the department at least fifteen days prior to date of examination.

H. W. GREFE,
Director of Examinations and Licenses.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The seventh annual meeting of the Southwestern Society of Orthodontists will be held at El Paso, Texas, Dec. 5-8, 1927, Hotel Paso del Norte. A cordial invitation is extended to all ethical members of the dental and allied professions.

P. G. SPENCER, *Secretary*,
1407 Amicable Bldg.,
Waco, Texas.

ALPHA OMEGA FRATERNITY

The twentieth annual convention of the Alpha Omega Fraternity will be held at the Southern Hotel, Baltimore, Md., Dec. 25-27, 1927. The supreme scribe is desirous of obtaining the correct address, chapter and class year of all *fraters*.

By order of

ALVIN H. BERMAN, *Supreme Chancellor*,
610 North Gay St., Baltimore, Md.

A. M. FLASCHNER, *Supreme Scribe*,
419 Boylston St., Boston, Mass.

DINNER TO DR. TRACY

At the Better Dentistry meeting of the First District Dental Society, December 5-7, 1927, a testimonial dinner will be tendered to William Dwight Tracy. An engrossed testimonial book enclosing personal letters of congratulation will be presented to him. All

his friends who would like to be represented in this book may send such congratulatory letters to Dr. Tracy, addressed to the chairman, on or before Nov. 20, 1927.

C. FRANKLIN MACDONALD, *Chairman*,
34 East Fifty-First St.,
New York City.

RESOLUTION ON THE DEATH OF DR. DRIEHAUS

WHEREAS, it has pleased God in His infinite wisdom to remove from our midst our beloved friend and fellow member, Arnold C. Driehaus, who for many years has administered through his skill to the health, happiness and comfort of a large clientele in this city; therefore, be it

Resolved, that we, the members of the Colorado Springs Dental Society, recognize the sterling worth of Arnold Driehaus. He was a man of outstanding good character—a dentist of high ability. He was always interested in better dentistry, especially for the children in our schools. Hundreds of children in this city will have cause to remember his skill and his kindly administrations. We, his fellow members, realize our great loss; therefore, be it further

Resolved, that our secretary be instructed to inscribe in our minute book these resolutions and send a copy, thereof to the family of the deceased, and another copy to the dental journals for publication.

A. B. BAKER.
EDWIN F. BACKUS.
GEORGE Y. WILSON.
Committee.

PATENTS OF INTEREST TO DENTISTS

1512686. Dental impression tray, George A. Harper, Shreveport, La.

1512633. Dental floss holder, John A. Peckham, Roxbury, Mass.

1513696. Manufacture of gold leaf, Friedrich Demel, Twickenham, England.

15113104. Toothbrush, C. H. Gracey, Detroit, Mich.

1512942. Toothbrush holder, Nina M. Mahaffy, Armada, Mich.

1513178. Toothbrush, Frank H. Mayhood, Calgary, Canada.

1505792. Dental device, Louis O. Ludlum, St. Louis, Mich.

1506332. Bib or apron for dentists' use and the like, W. O. Bloom, Boylston, Mass.

1506417. Tooth-cleansing device, Stanley M. Donals, Rochester, N. Y.

1506007. Artificial-tooth mounting, Hugo Kraus, Chicago, Ill.

1506078. Dental polishing disk, George A. Parks, Sherrard, Ill.

1506328. Dental equipment stand, A. F. Pieper, Rochester, N. Y.

1506257. Sanitary inclosing means for toothbrushes, H. P. Schmidt, New York City.

1506401. Toothbrush, John H. Young, Norbury, England.

1513730. Anesthetic compound, Roger Adams, R. L. Jenkins, Urbana, Ill., and E. H. Volwiler, Chicago, Ill.

1514420. Rotary toothbrush, A. V. Bigwood, Scotia, N. Y., and L. Kozelek, Schenectady, N. Y.

65900. Des., Hypodermic syringe, Harvey S. Cook, Valparaiso, Ind.

1514319. Centrifugal casting machine, W. T. Janney, Philadelphia, Pa.

1514320. Centrifugal casting machine, W. T. Janney, Philadelphia, Pa.

1514064. Alloy intended for castings, A. J. Mandell, Forest Hills, N. Y.

1514018. Dentifrice dispensing device, Oscar R. Sharpe, East San Gabriel, Calif.

1514267. Removable bridgework attachment, Isidore Stern, New York City.

1514891. Dental bridge anchor, Ward L. Baumgardner and E. H. Hall, Columbus, Ohio.

1516003. Artificial tooth, John B. Davis, Lansdowne, Pa.

1516398. Gum dentifrice, Charles McDowell, Rapid City, S. D.

1516206. Tooth-cleaning preparation, Carl Pfanstiehl, Highland Park, Ill.

1517186. Handpiece for dental drills, W. H. Bond, Sarasota, Fla.

1517197. Pad for dental impression trays, Vincent Cuttitta, New York City.

1517208. Dental device, R. H. Gillespie and J. G. Vaughn, Pine Bluff, Ark.

1516933. Guard for handpieces of dental engines, G. E. Terranova, New Haven, Conn.

1517038. Device for removing wax from artificial denture casts, Berte Watson, Port Elizabeth, South Africa.

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